



SUPPLY CHAIN MANAGEMENT THIRUVANANTHAPURAM

SPECIFICATION

THREE PHASE ENERGY METERS

APPLICABLE TO KSEBL	Rev#0.1	DOC. NO.: SCM-SPEC/XD/Three phase Energy Meters
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Technical Committee

1. Chief Engineer- SCM
2. Deputy Chief Engineer -SCM
3. Executive Engineer TMR Thirumala
4. Executive Engineer TMR Pallom
5. Executive Engineer TMR Angamaly
6. Executive Engineer TMR Shoranur
7. Executive Engineer TMR Kannur
8. Executive Engineer(D)-O/o CE-SCM
9. Executive Engineer RITU Kochi



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Thiruvananthapuram
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TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

(i) Document Approval & Control Status

	Compiled by	Verified by	Approved by
Name	Smt. Suja Maria Paul	Sri. Sunil .K	Sri. Sanal Kumar K
Position	Asst. Executive Engineer (O/o Chief Engineer, Supply Chain Management)	Executive Engineer(D) (O/o Chief Engineer, Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	15-01-2020	15-01-2020	15-01-2020
Signature	Sd/-	Sd/-	Sd/-

(ii) Revision Approval & Control Status

	Compiled by	Verified by	Approved by
Name	Smt. Suja Maria Paul	Sri. Sunil .K	Sri. Suresh Kumar C
Position	Asst. Executive Engineer (O/o Chief Engineer, Supply Chain Management)	Executive Engineer(D) (O/o Chief Engineer, Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	11-06-2021	11-06-2021	11-06-2021
Signature	Sd/-	Sd/-	Sd/-

(ii) Amendments and History

Sec. #	Rev. #	Date	History of Change
Clause 17 Component Specification	0.1	11-06-2021	Item No.2 Memory chips- ROHM added



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

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1. Purpose

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **Three Phase Energy Meters** in a professional manner.

2. Scope

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL, Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **Three phase Energy Meters** used in field by KSEBL.

3. Responsibility

Executive Engineer (D), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions.

4. Procedure For Revision

Modifications if any, in the technical Specification will be incorporated as **Revisions** . Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev No. 0.1, 0.2 etc .**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev No. 1.0, 2.0 etc .**

All the details regarding the revisions (both minor and major) will be incorporated in “(ii)-**Amendments and history** “ above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer- SCM**. Those who notice any discrepancy or have any suggestion regarding revision , may bring the matter to the attention of Chief Engineer -SCM in writing or through e-mail id: cescm@kseb.in



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

CONTENTS

1. SCOPE	5
2. STANDARD APPLICABLE	5
3. SERVICE CONDITIONS.....	6
4. CURRENT & VOLTAGE RATINGS	7
5. GENERAL REQUIREMENTS.....	8
6. DESIGN AND CONSTRUCTIONAL REQUIREMENTS	9
7. OPERATIONAL REQUIREMENTS	27
8. CONNECTION DIAGRAM AND TERMINAL MARKINGS	30
9. NAME PLATE DETAILS	30
10. DATA COMMUNICATION FACILITIES	31
11. BILLING HISTORY AND LOAD SURVEY.....	32
12. TESTS.....	33
13. GUARANTEE	40
14. QUALITY CONTROL.....	41
15. MINIMUM TESTING FACILITIES REQUIRED AT MANUFACTURERS END.....	41
16. QUALITY ASSURANCE PLAN	42
17. COMPONENT SPECIFICATION.....	43
<u>GUARANTEED TECHNICAL PARTICULARS.....</u>	<u>45</u>



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

TECHNICAL SPECIFICATION FOR THREE PHASE, FOUR WIRE, WHOLE CURRENT, 10- 60A, STATIC ENERGY

METER OF CLASS 1 ACCURACY AND WITH LCD AND TOD FACILITY -

1) SCOPE

This specification covers the design, manufacture, testing and supply of DLMS compliant & AMR compatible, Category C2, 3 phase, 4 wire static trivector meter of accuracy class 1.0 with ToD register and LCD Display with backlit (Green Colour) and having ISI Marking, suitable for measurement of active kWh, reactive energy kVARh and apparent energy kVAh, kVA MD and kW MD at nominal frequency in the range of 47.5 Hz to 52.5 Hz in balanced as well as unbalanced load conditions.

2) STANDARDS APPLICABLE

Sl.No.	Standard No.	Title
1)	IS:13779/1999 with latest amendments	Specification of AC Static Watt hour meters, class 1.0 & 2.0
2)	CBIP Report No 325	CBIP guide on Static energy meters-specification and testing
3)	IEC:61036-2000	Specification for AC static Watt-hour Meters, Class 1&2.
4)	IS:9000	Basic Environmental Testing Procedures for Electronic & Electrical items
5)	IEC:1036	Static Energy Meters
6)	IEC:62052-11	Electrically Metering equipment (AC) – General Requirement, Test & Test Condition.
7)	IEC:62053-21	Static Energy Meters for Active Energy
8)	IS:12346	Specification for testing equipments for ac energy meters.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

9)	IS:15959:2011 and its latest amendments	Data Exchange/ DLMS
10)	IS:12063	Degree of Protection
11)	ANSI/IPC-A-610	Assembling Standard of Electronic components.
12)	IEC:61000-4-5/2001-04	EMC-Testing and Measurement techniques, Surge immunity test.
13)	IS: 15707:2006	Testing, Evaluation, Installation and Maintenance of AC Electrical Meter – Code of Practice

In case of any conflict or discrepancy, the order of precedence shall be

1. IS
2. CBIP guide on static Energy meters – Specification and testing Research Publication No.325.
3. IEC

In case of any difference between provisions of these standards and the provisions of this specification, the provisions contained in this specification shall prevail.

3) SERVICE CONDITIONS

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

1)	Maximum Annual Rainfall (mm)	:	5000
2)	Average Annual Rainfall (mm)	:	3107
3)	Specified operation range of temperature	:	00C to 550C



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

4)	Limit of range of operation of temperature	:	100 C to 60 0
5)	Limit of temperature range for storage and transport	:	-100C to 700C
6)	Moderately hot and humid climate, conducive to rust and fungus growth. Relative humidity (%)	:	50-99
7)	Average no. of thunderstorm days/annum (Isoceraunic level)	:	80-100
8)	Average number of dust storm days per annum	:	5
9)	Average number of rainy days per annum	:	120-140
10)	Average number of tropical monsoon months per annum	:	6 months
11)	Annual rain fall	:	10 cms to 150 cms
12)	Seismic level (Horizontal accn)	:	0.30g
13)	Maximum Wind Pressure	:	150kg /sq.mt.

4) CURRENT & VOLTAGE RATINGS

Voltage rating : 415V between phases and 240V between phase and neutral.

Voltage variation : +20% to -40%.

Standard Basic Current I_b : 10 A

Rated maximum current I_{max} : 60A (600% of I_b)

Standard frequency : 50Hz \pm 5%



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Power Factor : should work for zero to upf (lag or lead).

Starting Current : 0.2% of Ib at Unity Power factor

5) GENERAL REQUIREMENTS

5.1. The firm should have valid BIS Certification, S' mark and ISO Certification 9001/14001.

5.2. The standard reference temperature for performance shall be $27^{\circ}\text{C} \pm 20^{\circ}\text{C}$. If tests are made at a temperature other than that of reference temperature, the results shall be corrected by applying the appropriate temperature coefficient of the meter.

5.3. Unless otherwise specified, the meter should conform to all applicable clauses of standards specified above.

5.4. The meter should start registering the energy at 0.2 % of basic current.

5.5. The meter shall withstand and operate satisfactorily without loss of accuracy under the most hazardous tropical climatic conditions including that specified above.

5.6. Class of Accuracy:

5.6.1. The class of accuracy of meter should be 1 or better.

5.6.2. The meter should show the readings having an error less than the limits of permissible percentage for all values of current between 5% of basic current and of the maximum current for all power factor as stipulated in standards when it is under balanced as well as unbalanced loads and under reference conditions.

5.6.3. The accuracy shall not drift with time.

5.6.4. Due to the influence of self heating, the error should not exceed 0.2%.

5.6.5. The meter shall be able to carry for 0.5 Second a current equal to 20 times the maximum current and the variation in percentage error should be as per standard.

5.6.6. Voltage dips and interruptions shall not produce a change in register of more than 0.002 kWh/0.003kVAh.

5.6.7. The accuracy of the meter should not be affected with the application of abnormal voltage/ frequency generating device such as spark discharge of approximately 35 kV

a) On any of the phases and neutral terminals

b) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap) and at any place in load circuit



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

The accuracy of meter shall be checked before and after the application of above device. (35kV test on RS232 port is not needed)

5.6.8. In case any drift is noticed in the accuracy of the meter, which is beyond the permissible limits, the concerned meter shall be withdrawn from service and the manufacturer shall supply a new meter without any extra cost as a replacement (within three months of receipt from KSEBL), during the guarantee period.

At any case the overall failure rate of meters should not be more than 2.5% of the quantity supplied. Delay in replacement, will be treated as per the clause specified for replacement of faulty meter.

5.7 Power Consumption:-

5.7.1 Voltage Circuit: The active & apparent power consumption of voltage circuit including power supply of meter at reference voltage, reference temperature & frequency shall not exceed 1.0 Watt & 4.0 VA per phase.

5.7.2 Current Circuit: The apparent power taken by current circuit at basic current, reference frequency & reference temperature shall not exceed 1.0 VA.

5.7.3 The apparent and active power consumption of each circuit of a meter at reference voltage/ current mentioned above is for reference frequency and reference temperature.

6) DESIGN AND CONSTRUCTIONAL REQUIREMENTS:-

6.1. Meters shall be designed and constructed in such a way that in normal conditions, working personnel safety against electric shock and non effectiveness of excessive temperature are ensured.

6.2. Meters shall be projection type and shall have IP51 or better degree of protection.

6.3. Direct Sunrays may be falling on the Energy Meter and it shall be designed to withstand the temperature.

6.4. Unless otherwise specified, features of meter should be that of insulating encased meter of protective class II as elaborated in CBIP 325 mentioned in this specification.

6.5. Design:-

6.5.1 All insulating materials used in the construction of the meter shall be substantially non- hygroscopic, non ageing and of tested quality.

6.5.2 Parts and surfaces, which are subjected to corrosion, shall be provided with protective coating to achieve durable results.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

6.5.3 The meter shall have a wireless design.

6.5.4 The meter shall have a Test Output, Operation Indicator and nonvolatile memory.

6.5.5 Meters shall be designed and constructed in such a way as to avoid introducing any danger in normal use under normal conditions, so as to ensure especially:

Personnel safety against electric shock

Personnel safety against effects of excessive temperature

Protection against spread of fire

Protection against penetration of solid objects, dust and water and

Detection of fraud/ pilferage.

6.5.6. Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving parts; electronic components shall be assembled on printed circuit board using surface mounting technology (SMT).

6.5.7. Factory calibration using high accuracy software based test bench shall be used considering the error of standard in overall accuracy as per table 1 of IS 12346.

6.5.8. Assembly of electronic components shall be as per ANSI/IPC-A-610 standard.

6.5.9. Internal power supply circuit shall be designed using highly reliable components. Critical components such as metering ICs (ASIC), Microcontroller etc. shall be procured from STACK or IECQ registered suppliers.

6.5.10. Suitable measure shall be taken in 'Phase' and 'Neutral' circuit to achieve isolation against external interference /electrical spikes.

6.5.11. The measurement by meter shall not get influenced by injection of high frequency AC Voltage/ chopped signal / DC signal and harmonics on the terminals of the meter.(Variation shall be as per clause 7.1.5)

6.5.12. Complete metering system & measurement shall be immune to the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The meter shall be designed in such a way that conducted, radiated or induced electromagnetic as well as electrostatic discharge due to the following disturbances do not damage or influence the meter. As per IS(Type test)

1. Electrostatic discharges

2. Electromagnetically induced fields



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

3. Electromagnetic radiated RF fields
4. Electromagnetic conducted RF fields
5. Electrical fast transients/ bursts
6. Surges
7. Oscillatory waves

6.5.13. The meter's accuracy shall not be affected at all by magnetic field from all sides of the meter as defined in CBIP 325 report.(Refer clause 6.8.7.8)

6.5.14. Power supply unit in the meter should be transformer less, preferably micro controller type to avoid magnetic influence.

6.5.15. Meter shall be with no external links between voltage and current circuit.

6.5.16. The meter shall be capable to withstand phase to phase voltage (440V) if applied between phase and neutral for minimum 5 min.

6.5.17. The meter shall record and display total energy including harmonic energy.

6.5.18 Under normal conditions of use, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the meter. The temperature rise at any point of the external surface of the meter should not exceed 200K with ambient temperature at 25 0C to 45 0C.

6.5.19 Meter shall withstand an impulse voltage of 10 kV peak. The waveform and the generator characteristics used for testing shall be in accordance with IEC 62052-11, clause 7.3.2.

6.5.20 kVAh measurement should be the vector sum of active and reactive energy, even

though the vector sum value tends to be the same as arithmetic sum value while

calculating the kVAh as above. Leading pf is to be recorded as lead.

The following energies shall be recorded and separate registers are to be added accordingly.

Bill kWh lag

Bill kWh lead

Bill kVAh lag

Bill kVAh lead



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Cumulative kWh Lead

Cumulative kWh Lag

Cumulative kVAh Lead

Cumulative kVAh Lag

6.6 ToD Timings:- Total 6 Nos.TOD registers required. As per IS 15959 TOD is a programable parameter. By default 3TOD will be enabled in display. If needed 6 TOD should be configurable by CMRI/base computer using DLMS software with proper authentication.i.e The time zones other than the 3TOD shall not be displayed but be made available in display.Change of time blocks for TOD metering shall be with password enabling from CMRI and from base computer.

Presently there are three numbers of TOD zones as given below (Time block and TOD zones subject to change)

Time zone 1 : 6.00hrs to 18:00hrs.

Time zone 2 : 18.00hrs to 22.00hrs.

Time zone 3 : 22.00hrs to 6.00hrs.

Cumulative forward kWh shall be displayed for 20 seconds & all other parameters shall be displayed for minimum 6 seconds including LCD check.

6.7 Manufacturing Process, Assembly, Testing:-

6.7.1 Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. All inward flow of major components and sub assembly parts (CT, PT, RTCs/Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification.

6.7.2 Multi-layer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits.

6.7.3 SMT component shall be assembled using automatic 'pick-and-place' machines with in process 7 stages, Re-flow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice.

6.7.4 Assembly line of the manufacturing system shall have provision for testing of sub-

assembled cards. Manual placing of components and soldering, is to be minimized to items, which cannot be handled by automatic machine.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

6.7.5 Handling of 'PCB' with ICs/C-MOS components is to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided.

6.7.6 Complete assembled and soldered PCB should undergo functional testing using computerized Automatic Test Equipment.

6.7.7 Test points should be provided to check the performance of each block/stage of the meter circuitry.

6.7.8 Testing at intermediate and final stage is to be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

6.8 Construction:-

6.8.1 Meter Base & Cover:-

6.8.1.1 The meter base & cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities which is unbreakable, corrosion resistant & inert to chemicals, flame retardant, immune to ultra violet radiation.

6.8.1.2 The meter case and cover should meet UV ageing test as per ASTM standards.

6.8.1.3 The manufacturer shall indicate hardness, melting temperature and tensile yield strength of the material and necessary test certificate of the same shall be furnished.

6.8.1.4 The cover shall be transparent. There shall be provision for taking correct reading as specified in the CEA regulation.

6.8.1.5 The base and cover shall be ultra-sonically (continuous welding) or chemically (provided the chemical welding shall be done properly as per the standards) welded so that once the meter is manufactured and tested at factory, it should not be possible to open the cover at site except the terminal cover. Chemical welding / Single mould is also allowed.

6.8.1.6 The Manufacturer shall put one seal on meter body before dispatch. Polycarbonate or acrylic or holographic seals shall be used. In the case of Integrated snapfit seals, manufacturer should provide 2 seals. Lead seals are not permitted at all. If the meter is offered in single mould, adequate number of seals shall be provided. Refer clause 6.8.3.1 for details.

6.8.1.7 The thickness of material for meter body should be 2 ± 0.2 mm minimum.

6.8.1.8 The bidder shall indicate hardness, melting temperature and tensile yield strength of the material used for the manufacture and necessary test certificate of the same shall be furnished.

6.8.1.9 The polycarbonate material used shall conform to the test requirement of heat deflection test as per ISO: 75 and glow wire test as per the relevant Standard. The details are as depicted in table below:

SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Sl. 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 60oC, 4 Hours condensation at 50oC	4 Hours UV at 60oC, 4 Hours condensation at 50oC
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-60596-10-2	125oC +/- 2oC	125oC +/- 2oC
4)	Flammability Test a) As per UL 94 or b) As per IS:11731 (Part-2) 1986	VO FVO	VO FVO
5)	Heat deflection Temp. (HDT) HDT/Ae, 1.8 Mpa edge (100mm) As per ISO 75/Ae	132°C	125°C
Sl.No	Test	Terminal Block	Transparent material for meter cover & terminal cover
1)	Glow wire test IS:11000 (Part-2/ SEC-1) 1984 OR	960°C +/- 15°C	650°C +/- 10°C



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
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TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

	IEC PUB, 60695-2-12		
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6.8.1.10 The meter shall be provided with adequate shielding to withstand external magnetic influence from all directions as per CBIP 325.

6.8.1.11 The housing shall be provided with a keyhole on the top for fixing, which will not be accessible to the outsider after mounting and the terminal cover sealed. The keyhole shall be so constructed that it shall not affect the degree of ingress protection.

6.8.1.12 Leaflet/manual of the meter and adequate fixing screws shall be enclosed inside the packing along with each meter.

6.8.1.13 Display legends of main measurement quantities shall be printed on the meter cover/terminal cover or provided as sticker inside the terminal cover for providing information of the legend used to define the main measurement quantities.

6.8.2 Terminal Arrangement, Terminal Block and Cover:-

6.8.2.1. Terminals may be grouped in (a) terminal block(s) having adequate insulating properties and mechanical strength.

6.8.2.2. The terminal arrangement and connection diagram shall conform to IS: 13779. Terminal arrangement shall be marked on terminals as well as in the connection diagram.

6.8.2.3. Terminals shall be designed to carry I_{max} continuously and under this condition, the temperature at the terminal block shall not exceed 700C with ambient temperature within operating temperature range as defined by IS:13779.

6.8.2.4. The terminal block base shall be of same material as meter case or any other superior industrial plastic material having sufficient thickness to cover its back and provide enough strength for the purpose of tightening of screws.

6.8.2.5. The wall fixing arrangements (left and right bottom) of the meter shall be strong enough to avoid damage during the tightening of screws and shall be provided inside the terminal cover. The clamping screws for the terminal cover should have metallic sleeve moulded within the block to avoid damage during tightening of the screws.

6.8.2.6. The terminal block shall have adequate insulating properties and mechanical strength. The terminal block shall be made from best quality non-hygroscopic, flame retardant polycarbonate material or any other superior industrial plastic material (capable of passing the flammability tests give in IS: 11731) with nickel- plated brass inserts for connecting terminals. The material shall be capable of passing the test given in ISO:75 for temperature of 132 0C and pressure of 1.8 MPa.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

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Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

6.8.2.7. The termination arrangement shall be provided with an extended transparent terminal cover as per relevant clause of CBIP Guide on Static Energy Meters – Specification and testing and shall be sealable independently to prevent unauthorized tampering. The terminal cover of the meter shall be fully covered. Sealing provision shall be made against opening of the terminal cover. It is necessary to provide suitable screws with two holes for sealing purpose.

6.8.2.8. The terminals in the terminal block shall be of long socket type suitable for connection of cables with aluminium conductors along with suitable lugs having cross sectional area, with adequate length. Double screw arrangement shall be provided to achieve adequate termination. All terminals and connecting screws and washers shall be of tinned / nickel plated brass material.

6.8.2.9. The terminal screws shall have size not less than M6 with Integrated head.

6.8.2.10. Cage clamp design/barrel type arrangement shall be provided for the Terminal block .

(OR)

Two screws should be provided in each terminal. The terminals in the terminals block shall be of adequate length in order to have proper grip of conductor with the help of two screws.

6.8.2.11. The screw shall not have pointed end of threads. The ends of screws shall be such as not to pierce and cut the conductor used. The internal diameter of terminal hole should be 8.5 mm minimum (as per table 2 of CBIP). The holes in the insulating material which form an extension of the terminal holes shall be sufficient in size to accommodate the insulation of 6mm² weather proof Al conductor.

6.8.2.12. The terminal cover shall be transparent with minimum thickness 2 ± 0.2 mm and the material shall be same as that of meter case. It shall be of extended type and accommodate, in addition to the terminal block, a suitable length of external cable along with its insulation and suitable for wiring from the rear end of the meter board.

6.8.2.13. All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.

6.8.2.14. The fixing screws used on terminal cover for fixing and sealing shall be held captive in the terminal cover. When the meter is mounted on the meter board, no access shall be possible to the terminals without breaking the seals of the terminal. The meter shall be firmly fixed and shall not be tilted when fixed.

6.8.2.15. The terminal block, terminal cover and meter case shall fulfill the test conditions for heat and fire resistance.

6.8.2.16 The clearance and creepage distance of the terminal block and those between the terminals and the surrounding parts shall not be less than 3mm. Clearance of minimum 3mm shall be provided between the incoming and outgoing terminals.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

6.8.3. Sealing Arrangement

6.8.3.1 The Manufacturer shall put one seal ensuring traceability on the meter body before dispatch. Polycarbonate or acrylic or holographic seals shall be used. Lead seals are not permitted at all. Provision for sealing by the utility shall also be there.

The Manufacturer shall supply three seals for the optical port, reset button and meter body along with each meter inside the packing. The seals shall have Barcode incorporating Sl. No. (engraved, embossed or printed) on one side and KSEBL logo on the other side. Single mould meter with password security lock for optical port acceptable. However external sealing for optical port is required.

The type of bar code shall be "Code 128".

The seals provided by the manufacturer at factory shall be a coloured one and in addition to the one coloured seal provided by the manufacturer before dispatch, three colourless seals shall be provided as below.

Meter body – 1 , Optical port – 1

MD reset button – 1, 5% extra colourless seals shall be supplied separately.

The seals should have serial numbers. A soft copy (in spread sheet compatible with open office calc/ Microsoft excel or in.csv format) of the No. of the seal against the Sl. No. of each meter should be submitted to the consignee along with each lot of supply. Serial numbers of seals supplied extra shall also be given as extra soft copy.

Terminal block (Meter Terminal Cover) shall be provided with separate sealing facility (at least two seals) which can be used by testing / commercial group of power utility as follows

- (a) One seal at left bottom (b) The other seal at right bottom

(OR)

Meter terminal cover shall be hinged to the left/ top side of terminal block and there shall be provision for one seal to be put by utility at the central portion of the Meter Terminal cover.

The hinge, fixing screws used on terminal cover for fixing and sealing shall be held captive in the terminal cover. Meter terminal cover shall not be detachable without breaking the seal of the sealing screw. When the meter is mounted on the meter board, no access shall be possible to the terminals without breaking the seals of the terminal.

6.8.3.4 There shall be provision for sealing the optical port also.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

6.8.4 Real Time Clock:-

6.8.4.1 The real time quartz clock (RTC) shall only be used in the meter for maintaining time (IST) and calendar. The time accuracy shall be as per provision of CBIP-325 Tech. report. Facility for adjustment of real time should be provided through CMRI & Laptop (or base computer) with proper security.

6.8.4.2 RTC shall be pre-programmed for 15 Years Day/date without any necessity for correction. Maximum drift shall not exceed +/- 300 Seconds per year.

6.8.4.3 The uncertainty of setting initial time shall not be more than ± 30 seconds from Indian Standard Time as maintained by NPL, New Delhi.

6.8.4.4 The RTC shall have long life (10 Years) non-rechargeable battery.

6.8.4.5 Time & date setting shall only be possible through Common Meter Reading Instrument (CMRI) & Laptop (or base computer).

6.8.4.6 Synchronization of Energy Meter 'RTC' Time/Date shall be possible through password/Key code enabled command from PC/ Laptop (BCS)/CMRI

6.8.4.7 The RTC battery and battery for display in the case of power failure should be separate.

6.8.5 Testing on Site:-

6.8.5.1. The meter shall be provided with flashing LED to represent the pulse output for testing the meter by suitable testing equipment. The operation indicator must be visible from the front.

6.8.5.2. It shall be possible to check the accuracy of active & reactive energy measurement of the meter on site by means of separate LED output. Resolution of the test shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.

6.8.6. Display of Measured Values

6.8.6.1 The push button shall be provided for manual scroll mode and it should be easily accessible for one from the front side of the meter body when the meter is installed. It should be possible to scroll Up and down using pushbuttons in complete cyclic manner.

It shall be possible to select Display modes & pages using pushbuttons. Separate scroll buttons shall be available for upward & downward scrolling.

6.8.6.2 Switching the Display mode:-

a) The display mode shall be switched to 'Auto Scroll Mode' if the scroll button is

(i) Not pressed during the last 1 minute (If in the 'Manual Scroll mode')



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

(ii) Not pressed during the last 30 minute (If in the 'High Resolution mode')

b) 1.The display mode shall be switched to 'Manual Scroll mode' by pressing the up and down scroll buttons together for 5 seconds.

2. The display mode shall be switched to 'Next Push button Mode' if the up and down scroll buttons are pressed together for 5 seconds.

6.8.6.3 The meter shall have 7 digits with parameter identifier and backlit Liquid Crystal Display (LCD) (green). The size of digit should be minimum 10x5mm. The Dot Matrix type LCD is not acceptable . Display legend shall be readable. Backlit(green colour) shall be provided for the display.

6.8.6.4 LCD shall be suitable for temperature withstands of 700C .When the meter is placed in an enclosure at a constant temperature of 70°C for a period of 30 minutes the character of LCD should not deform and also work satisfactorily when restored at normal temperature.

6.8.6.5 The meter should have a nonvolatile memory, so that the registered parameters will not be affected by the loss of power. The non-volatile memory shall have a minimum retention time of 10 years.

6.8.6.6 For a clear visibility of the display of the meter reading at a distance large viewing area with large display icons is preferred. The display should not be affected by electrical & mechanical disturbances.

Following measuring parameters should be displayed:

Display Parameters Push Button Mode I (The same parameters shall be displayed in Auto SCROLL MODE also):-
The meter should be capable of displaying the following parameters automatically.

1.Self diagnostic (LCD) segment check & Battery check

2.Real time & date

3.Present Status of tamper if any. If there is tamper it may be displayed Yes, and the type of tamper If no tamper detected, the display shall be 'Tamp nil '.

4.Phase sequence of Supply system - should be available in single display parameter

5.Cumulative kWh (Decimal place shall not be displayed.)

6.TOD wise Cumulative Forward kWh [kWh1(zone1), kWh2(zone2), kWh3(zone3) (Decimal place shall not be displayed.)

7.Bill period cumulative kWh

8.TOD wise Bill period kWh (KWh reading at the time of last reset) (Decimal



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

place shall not be displayed.)

9. Instantaneous Phase Voltage (VR, VY, VB) (Phase to neutral voltage)

10. Instantaneous Phase current (IR, IY, IB)

11. Bill period average power factor

12. Power Factor instantaneous (Lag or lead)

13. Instantaneous kW

14. Bill period TOD wise MD in kVA with date & Time (monthly MD recorded up to the time of last reset)

15. Bill period cumulative kVAh

16. TOD wise Bill period kVAh (kVAh reading at the time of last reset) (Decimal place shall not be displayed.)

17. Cumulative Reactive Energy – (kVARh) Lag

18. Cumulative Reactive Energy – (kVARh) Lead

The above mentioned display parameters may be displayed on a module with backlit (green colour) display .

B. Display Parameters MODE II (PUSH BUTTON MODE) The meter should be capable of displaying the following parameters using push button.

1. Self diagnostic (LCD) segment check & Battery check

2. Meter ID

3. Frequency

4. Cumulative kWh

5. Current Month Avg PF

6. Average PF lag

7. Average PF lead

8. Instantaneous kW

9. Instantaneous kVA

10. Rising Demand in kVA (30 minutes integration with elapsed time)



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

- 11.Cumulative kVAh
- 12.TOD wise Cumulative Apparent Energy –(kVAh1, kVAh2, kVAh3)
- 13.Resultant MD in KW
- 14.Cumulative MD in KW
- 15.TOD wise Maximum Demand in kW (MD1, MD2, MD3) since reset with date and time
- 16.Bill kWh lag
- 17.Bill kWh lead
- 18.Cumulative kWh Lead
- 19.Cumulative kWh Lag
- 20.Resultant MD in KVA
- 21.Cumulative MD in kVA
- 22.TOD wise Maximum Demand in kVA (kVA1, kVA2, kVA3) since reset with date and time
- 23.History1:Cumulative kWh (TOD Zone1)
- 24.History1:Cumulative kWh (TOD Zone2)
- 25.History1:Cumulative kWh (TOD Zone3)
- 26.History2:Cumulative kWh
- 27.History3:Cumulative kWh
- 28.History4:Cumulative kWh
- 29.History5:Cumulative kWh
- 30.History6:Cumulative kWh
- 31.History1:Cumulative kVAh (TOD Zone1)
- 32.History1:Cumulative kVAh (TOD Zone2)
- 33.History1:Cumulative kVAh (TOD Zone3)
- 34.History2:Cumulative kVAh



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

- 35.History3:Cumulative kVAh
- 36.History4:Cumulative kVAh
- 37.History5:Cumulative kVAh
- 38.History6:Cumulative kVAh
- 39.History1:Billing Maximum Demand in kVA (TOD Zone 1)
- 40.History1:Billing Maximum Demand in kVA (TOD Zone 2)
- 41.History1:Billing Maximum Demand in kVA (TOD Zone 3)
- 42.History2:Billing Maximum Demand in kVA
- 43.History3:Billing Maximum Demand in kVA
- 44.History4:Billing Maximum Demand in kVA
- 45.History5:Billing Maximum Demand in kVA
- 46.History6:Billing Maximum Demand in kVA
- 47.History1:Cumulative kVARh Lag
- 48.History2:Cumulative kVARh Lag
- 49.History3:Cumulative kVARh Lag
- 50.History4:Cumulative kVARh Lag
- 51.History5:Cumulative kVARh Lag
- 52.History6:Cumulative kVARh Lag
- 53.History1:Cumulative kVARh Lead
- 54.History2:Cumulative kVARh Lead
- 55.History3:Cumulative kVARh Lead
- 56.History4:Cumulative kVARh Lead
- 57.History5:Cumulative kVARh Lead
- 58.History6:Cumulative kVARh Lead



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

59.Number of tamper events

60.Latest tamper Details (with Date, Time & Duration) related to Bypassing of current coil, Missing Potential, current reversal in current coil, magnetic tamper and cover open). For phase sequence reversal, only display is needed. No need to provide it as a tamper. For other parameters latest tamper details (with date, & Time)are required as follows.

- Tamper id of latest occurred tamper
- Date and Time of Latest occurred tamper
- Tamper id of 2nd last occurred tamper
- Date and Time of 2nd last occurred tamper
- Tamper id of last restored tamper
- Date and Time of last restored tamper
- Tamper id of 2nd last restored tamper
- Date and Time of 2nd last restored tamper

. If OBIS codes are not available manufacturer specific OBIS codes may be used. if manufacturer specific OBIS codes are not available as per DLMS, appropriate codes shall be provided with approval of KSEBL.

61.Power OFF duration

62.Reset count

63.Program Count

C. Display MODE III (HIGH RESOLUTION MODE):-

1. Cumulative kWh (2+4) digits
2. Cumulative kVArh Lag (2+4) digits
3. Cumulative kVArh Lead (2+4) digits
4. Cumulative kVAh (2+4) digit

Note:-



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

1.The meter should be capable to reset automatically at 24.00 hours on the last date of the Calender month.(So that Meter Readers can take meter reading at any date in the succeeding month, as the previous month TOD wise readings (both MD and kWh) are available in the display

The meter shall have the following MD resetting options

- (a) Automatic reset at the end of certain pre-defined period (say end of the month)
- (b) Resetting through CMRI/ HHU
- (c) Manual resetting arrangement with sealing facility

Present Time Zone should be continuously indicated in display.

Note:- At any case all Parameters in accordance with DLMS specification shall be downloadable for analysis

6.8.6.7 Active cumulative energy shall be displayed for 20 seconds & all other parameters shall be displayed for minimum 6 seconds including LCD check in auto display cycling.

6.8.6.8 The maximum demand shall automatically be reset at 24:00 hours of the last day of each calendar month. Manual reset push button shall not be accessible without breaking the seal provided by the utility. Integration period for kW / kVA Maximum Demand should be of 30 minutes real time based.

The meter shall be supplied with battery backup feature for displaying the parameters during power OFF condition. Battery life should be minimum Ten years. Battery backup shall be provided internally.

6.8.7. Anti tamper Features:-

6.8.7.1 a) The meter shall detect and register the active and reactive energy correctly only in forward direction under 'change of phase sequence'.

b) The meter shall detect and register the active and reactive energy as per the prevailing electrical condition only in forward direction under 'change of any phase and neutral' .

c) The meter shall be capable of recording energy correctly even if input and output terminals are interchanged in any phase.

6.8.7.2 The meter should work accurately without earth.

6.8.7.3 The meter should work accurately even without neutral.

6.8.7.4 The meter should work in the absence of any one or two phases. It should show the readings accurately for the phases having connection irrespective of phase sequence.

6.8.7.5 All the above tampers will be verified at basic current at reference voltage.

6.8.7.6 The potential link shall not be provided on terminal block outside the main meter cover.

6.8.7.7 Visual indication shall be provided to show tamper conditions

6.8.7.8 The meter shall comply with all the test for external AC/DC magnetic field (0.2 T for DC & 10 mT for AC) as per CBIP 325 with latest amendments. Moreover, the magnetic influence test for permanent magnet of 0.5 T for minimum period of 15 minutes shall be carried out, by putting the magnet on the meter body. After removal of magnet, meter shall be subjected to accuracy test as per IS 13779/1999 amended up to date). Meter shall be immune to AC/DC magnetic influence upto threshold values specified above as per CBIP 325. Above the threshold values specified for AC/DC magnetic influences and all cases of permanent magnet influence tamper to be logged after 5 minutes of detection of external abnormal magnetic induction/field/influence conditions as per CBIP 325 with the meter logging the event with date and time at Reference voltage, (Vref), 100% maximum current (Imax) and UPF. Recovery shall be after 10 seconds.

6.8.7.9 In the event the meter is forcibly opened, even by 2mm displacement of the meter over from the original condition, same should be recorded as tamper event with date & time stamping and the meter should continuously display that the cover has been tampered. This display shall toggle with the normal display parameter.

The meter should be capable of recording the occurrences of a missing potential and its restoration with date and time of first such occurrence and last restoration along with total number and duration of such occurrences during the above period for all phases.

The tamper conditions to be provided as per table below:

Sl. No.	Tamper Type	Phase Wise	Logic & Threshold value	Persistence time	Restoration time
1)	Missing Potential	Yes	$V_x < 40\%$ of V reference i.e., 240 Volt irrespective to any other phase voltage	15 Minutes	5 Minutes
2)	Unbalancing of Voltage	No	$V_{max} - V_{min} > 10\%$ if max. voltage of 3 phase voltages and All voltages $> 60\%$ Vref.	15 Minutes	5 Minutes
3)	Current failure (CT	Yes	I_r or I_y or $I_b < 2\%$ of actual maximum and any one phase has	15 Minutes	5 Minutes



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

	Open)		value greater than 10% Ib.		
4)	Current unbalance	No	Difference of actual maximum and the minimum current >30% of actual maximum current and all phase has value greater than 10% Ib.	15 Minutes	5 Minutes
5)	Current Reversal	Yes	$I_x > 10\%$ of I_b and direction of current reverse and P.F value > 0.2	15 Minutes	5 Minutes
6)	Neutral Disturbance	No	Any two phase to neutral voltage is more than 350Volt & one phase to neutral voltage is less than 50Volt	15 Minutes	5 Minutes
7)	Magnet Tamper	No	The meter shall be immune to all magnetic influence. (Refer clause 6.8.7.8)	---	----
8)	Low Voltage	No	$V_x > 40\%$ V_{ref} and $V_x < 75\%$ V_{ref} .	15 Minutes	5 Minutes
9)	High Voltage	No	$V_x > 115\%$ of V_{ref} .	15 Minutes	5 Minutes

6.8.8. Self-diagnostic Tests:-

6.8.8.1 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 (all alpha numeric) on meter display
- c) Battery



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

d) Self diagnostic (RTC, NVM information) on display

6.8.8.2 All display segments: "LCD Test" display shall be provided for this purpose.

7. OPERATIONAL REQUIREMENTS:-

7.1 Limits of Error:-

1. Short time over currents should not damage the meter. The meter shall perform correctly when back to its initial working condition and the variation of error shall not exceed $\pm 0.5\%$. Meter shall be able to carry a current equal to $30 I_{max}$ with relative tolerance of 0% to -10% for 0.01 sec.

2. Voltage dips and short interruptions shall not produce a change in the register of more than X units and the test output shall not produce a signal equivalent of more than X units; and X is given by,

$$X = 10 - 6mVnI_{max}$$

Where m = No. of measuring elements

Vn = Reference Voltage in volts

I_{max} = Maximum current in amperes.

When the voltage is restored, the meter shall not have suffered degradation of its metrological characteristics.

3. The change of error due to abnormal voltage condition such as earth fault should not exceed at base current for active energy at upf and reactive energy at zpf more than $\pm 0.7\%$.

4. Removal of neutral shall not affect the operation of meter.

5. Limits of variation in percentage error due to change in voltages, frequency, waveform, voltage unbalance and phase sequence reversal etc. shall not exceed the values given in the table below .

Influence quantities	Value of current (balanced unless otherwise stated)	Cos Φ Or Sin Φ	Limit of variation in percentage error for class 1.0 meter
Voltage Variation $\pm 10\%$	$0.05I_b \leq I \leq I_{max}$	1	± 0.4
	$0.1I_b \leq I \leq I_{max}$	0.5	± 0.8

		inductive	
Voltage Variation between - 20% and +20%	$0.05I_b \leq I \leq I_{max}$	1	± 1.1
	$0.1I_b \leq I \leq I_{max}$	0.5 inductive	± 1.5
Frequency variation $\pm 5\%$	$0.05I_b \leq I \leq I_{max}$	1	± 0.4
	$0.1I_b \leq I \leq I_{max}$	0.5 inductive	± 0.4
Harmonic components in the current and voltage circuit**	0.5 I max.	1	± 0.5
Wave form: 10% third harmonic in current circuit**	$0.05I_b \leq I \leq I_{max}$	1	± 0.1
Odd harmonics/ sub harmonics in current circuit**	0.5I _b	1	± 3.0
DC and even harmonics in AC current circuit (As per relevant IS)	$I_{max}/\sqrt{2}$	1	± 3.0
Voltage unbalance(due to interruption of one or two phases)	I _b	1	± 2.0
Phase Sequence Reversal	0.1I _b	1	± 0.2

Stray DC magnetic induction of external origin	lb	1	$\pm 3.0^*$
Abnormal DC magnetic induction of external origin	lb	1	$\pm 4.0^*$
Stray AC magnetic induction of external origin	lb	1	$\pm 2.0^*$
Abnormal (10mT) AC magnetic induction of external origin	lb	1	$\pm 4.0^*$
Abnormal (200 mT) AC magnetic induction of external origin	lb	1	$\pm 4.0^*$

* Subject to the conditions of note of Table 17 in the 'Manual on Standardization

of AC Static Energy Meters'

** Applicable to active energy only

6. The difference between the percentage error in active energy (reactive energy) when the meter is carrying a single phase load and a balanced polyphase load at basic / rated current and at upf(zpf) shall not exceed 1.5%.

7.2. Abnormality of Events:-

1. The meter shall be capable to record power on/off events in the meter memory.
2. The meter shall keep working accurately irrespective of the phase sequence of the supply even if only one or two phases are available.
3. The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) applied on the metering system shall not affect the proper functioning and recording of energy as per error limits prescribed by CBIP.(Refer to the clause 6.8.7.8)
4. The meter shall be capable of detecting and recording phase wise occurrence and restoration with date and time in the cases of Potential Failure (one phase or two phases).



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

5. 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 15 minutes).
6. The tampers shall be provided as below as per IS 15959
 - a) Voltage related tamper – 100 (Missing potential, Potential imbalance, High voltage & Low voltage)
 - b) Current related – 200 (Current failure, Current unbalance, Current reversal, Current circuit short)
 - c) Others – 100 (Magnet and Neutral Disturbance)
 - d) Non roll over – 01
 - e) Power off – 99

The spare codes if needed shall be provided by the manufacturer.

8. Connection Diagram and Terminal Marking

8.1 Every meter shall be indelibly marked with a connection diagram showing the phase sequence for which it is intended and shall be clearly shown on the inside portion of the terminal cover and shall be of permanent nature. In case any special precautions need be taken at the time of testing the meter, the same may be indicated along with the circuit diagram.

8.2 Meter terminals shall also be marked and this marking should appear in the above diagram.

8.3 Stickers of any kind will not be accepted.

9. NAME PLATE DETAILS:-

Every meter shall have a nameplate clearly visible and indelible and distinctly marked in accordance with relevant standards. The following information shall appear on a nameplate preferably placed within the meter.

1. Manufacturer's name & trade-mark and place of manufacture.
2. Serial number (Serial Number should be in the name plate itself along with other details and should not be on the meter front cover)
3. Model or Type
4. Number of phases and number of wires for which the meter is suitable.
5. Guarantee period.
6. Purchaser's name



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

7. Purchase Order No.
8. Principal unit in which the meter records.
9. Reference voltage & frequency in Hz.
10. Basic current and rated maximum current .
11. Meter constant (pulse rate of testing signal).
12. Reference Temperature
13. Class index.
14. Month and Year of manufacture
15. BIS marking as per statutory requirement
16. 'DLMS' category C2

9.1 All the meter details should be delivered in soft copy (excel or .csv format) for the meters supplied to each TMR as per MDCC at the time of delivery along with the test report. After completion of Supply, the details of all meters in soft (excel or .csv format) shall be forwarded to the O/o Chief Engineer (SCM).

10. DATA COMMUNICATION FACILITIES:-

10.1. Data architecture and communication protocols shall enable easy multi-vendor exchange of data without usage of any converting/translating equipment. For this, the data structure adopted within the energy meter shall be on an internationally acceptable method. The data structure/coding details shall be furnished to the Owner. All necessary software required for down loading the information to a user friendly 'Windows'/LINUX based operating system of Base billing computer system through CMRI /Laptop shall be furnished in required number of copies (On CD) without any additional cost to the purchaser.

10.2. The data transfer shall be highly reliable and fraud proof (No editing shall be possible on base computer by any means).The software shall have capability to convert all the data into ASCII format.

10.3 Energy meter shall have a galvanically isolated optical communication port with proper cover & sealing facility in front of the meter for data transfer to or from a hand held CMRI and LAPTOP and a port for remote reading and both conforming to IS: 15959

1.LOCAL COMMUNICATION PORT:- The energy meter shall have a galvanically isolated IEC 1107 optical communication port with proper cover & sealing facility located in front of the meter for data transfer to or from a hand held Data Collection Device and PC/Laptop. The sealing provision should be available for optical port.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Sufficient (minimum 20 nos.) data transfer cable with connectors shall be provided for downloading data through optical port to PC/ Laptop without additional cost to purchaser.

2.REMOTE COMMUNICATION PORT:- Meter shall have an additional communication port (RS 232) in the form of RJ11 port to interface external modem for remote data collection. RS 232 (RJ11) port shall be preferably located under the terminal cover. RJ11 socket with pin configuration from left to right when the locking notch is positioned below.

Pin 1- No connection

Pin 2 – Ground

Pin 3 – PC Tx Meter Rx

Pin 4 - PC Rx Meter Tx

Pin 5 – Vcc

Pin 6 – No connection

The supplier may provide the pin configuration of RS232(in the form of RJ11socket) either on the meter body or in the mould itself stating the Tx and Rx of PC or Meter. Both the ports will support communication on DLMS and should be accessible through a DLMS compliant HHU. MicroUSB port may be provided additionally.

Provisions for sealing both the ports are to be made available.

10.4. METER READING DURING POWER OFF:- It should be possible to read the meter display visually and with CMRI in the absence of input voltages with the help of battery backup.

10.5. DATA DOWNLOADING CAPABILITY:- Meter shall support a minimum baud rate of 9600 on optical port as well as RS 232 remote communication port. It shall be possible to read selective data from the meter as specified in the companion standard.

11. Billing History and Load survey

The meter shall record the history of billing parameters, Cumulative kWh at the time of reset and kVA MD, for last 12 months.

Load survey parameters are kWh, kVAh, and MD (kVA), Phase Voltage, Phase current , kVARh (lag &lead).

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for the last 90 days on time basis. This load survey data can be retrieved using CMRI/Laptop/ any suitable equipment as and when desired and load profiles shall be viewed graphically or analytically with the help of meter application software. Whenever meter is taken out and brought to laboratory, the Load Survey data shall be retained for the period of



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

actual use of meter. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

12. Tests:-

12.1 The meter shall be tested with its base and cover in position; all parts intended to be earthed shall be earthed.

12.2 Before any test is made, the circuits shall have been energised for a time sufficient to reach thermal stability but not less than one hour.

12.3 The connection shall be done as marked on the diagram of connections.

12.4 The voltage and currents shall be substantially balanced. Voltage between line and neutral or between any two lines shall not differ from the average by more than 1% and current in the conductors shall not differ more than 2% from the average current. The phase displacement of each of these currents from the corresponding line-to-neutral voltage shall not differ from each other by more than 20.

12.5 All tests are to be carried out under reference conditions as specified in IS 13779/1999 unless otherwise specified. Permissible tolerances will be as mentioned in the table.

12.6 During the tests for accuracy requirements, proper repeatability conditions shall be maintained. During type tests, repeatability at any test point determined on the basis of three readings at short intervals, shall be better than 1/5 th of the limit of percentage error under reference conditions. Manufacturer shall state the necessary number of pulses/ pulse counts for maintaining the repeatability condition.

12.7 Uncertainty of measurement of percentage error shall not exceed 1/5 th of the limit of percentage error for the given test point at reference conditions. If the uncertainty exceeds this limit, all the limits of percentage errors shall be reduced as described in CBIP325.

12.8 Unless otherwise specified, procedure for carrying out tests and the results of those tests shall conform to the relevant clause CBIP325 and if it is not mentioned in the above manual, then to IS 13779/1999 (amended up to date).

A. Type Tests:-

12.9 Meter shall be fully type tested as per IS 13779/1999 (amended up to date), and CBIP 325.

12.10 Requirement of results and the procedure for conducting tests which are not specifically mentioned in this document shall be same as that mentioned in the CBIP 325.

12.11 The Type Test Reports shall clearly indicate the design and constructional features of the type tested meters.

12.12 Separate Type Test Reports for each offered type of meters shall be submitted.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

12.13 All the Type Tests shall have been carried out from Laboratories such as CPRI, Bhopal, ERDA, ERTL (East) or equally reputed and accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India to prove that the meters meet the requirements of the specification.

12.14 Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

12.15 Type test certificates rather than type test reports are preferred.

12.16 A test shall be carried out under reference voltage, rated frequency and $\cos \Phi$ ($\sin \Phi$) for active (reactive) energy meter with 5% of rated current and maximum continuous current. In each of these load conditions, 20 error tests are to be successively carried out at intervals of minimum 5 minutes. The variation in error expressed by the difference between the maximum and minimum of the errors so obtained in all these error tests shall not exceed the value corresponding to 1/5 th of the limit of percentage error at the test points.

12.17 Type tests shall be applied to three test specimens. All the specimens shall pass the type tests. In the event of one specimen failing, further three specimens can be taken.

12.18 Lists of tests to be carried are as follows:

a. Tests on Insulation Properties

Impulse Voltage Test

AC Voltage Test

Insulation Resistance Test

b. Tests on accuracy requirements

Test on limits of error

Test of meter constant

Test of starting condition

Test of no load condition

Repeatability of error test

Test of ambient temperature influence

Test of influence quantities



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

c. Tests on electrical requirements

Test of power consumption

Test of influence of supply voltage

Test of influence of short time over currents

Test of influence of self heating

Test of influence of heating

Test of abnormal voltage condition

d. Test for Electromagnetic Compatibility

Test of immunity to electrostatic discharge

Fast Transient burst test

Test of immunity to electromagnetic HF fields

Test of immunity to conducted disturbances induced by RF fields

Test of immunity to damped oscillatory waves

Test of immunity to surge

Radio interference suppression

Test of Climatic Conditions

Dry heat test

Cold test

Damp heat cycle test

f. Tests of Mechanical Requirements

1. Vibration Test

2. Shock test

3. Spring Hammer Test

4. Test of protection against penetration of dust and water (Degree of Protection)



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

5. Test on resistance to heat and fire

B. Routine and Acceptance Tests:-

12.19. Meters shall pass the entire acceptance and routine tests, as laid down in Manual on Standardization of AC Static Electrical Energy Meters, Pub. No. CBIP 325 and also additional acceptance tests as prescribed in this specification. 3 to 8 meters from a lot more than 1000 will be selected randomly in the factory and will be tested for tamper events.

12.20. Following routine tests are to be conducted on every product:

AC Voltage Test

Insulation Resistance Test

Test on limits of error

Test of meter constant

Test of starting condition

Test of no load condition

12.21 An acceptance test shall be carried out under the reference voltage, rated frequency and $\text{Cos } \Phi (\text{Sin } \Phi) = 1$ for active (reactive) energy meters at 5% of rated current. Six error tests are to be carried out successively in the load condition at intervals of 5 minutes. The variation in meter error expressed by the difference between the maximum and minimum of the errors so obtained in all these error tests shall not exceed the value corresponding to 1/5 th of the limit of percentage error at the test points.

12.22 Following acceptance tests are to be carried out on selected samples from a lot:

No load and starting conditions tests

AC Voltage Test

Insulation Resistance Test

Test on limits of error

Test of meter constant

Repeatability of error test

Test of power consumption

12.23 In addition to these acceptance tests following additional tests are to be conducted.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

12.24 Other Acceptance Tests:-

- i) The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage/problems,
- ii) Tamper conditions as stated in this specification,
- iii) Glow wire testing for polycarbonate material.

12.25 Normal Sampling Plan:-

1) For acceptance test, meters shall be selected at random from the lot, depending upon the size of the lot and the desired acceptance quantity level.

(a) No load condition & starting condition:-While accepting the meters at TMR Divisions, the number of sample meters will be taken out from the lot for testing (lot means the total number of meters received in a Store out of inspected and approved lot by purchaser's representative under one approval letter) depending upon the size of the lot and will be taken random from the lot in accordance with the following table.

Lot size	Number of meters to be selected at random
Upto 300	8
301 to 500	13
501 to 1000	20
1001 and above	32

Selection of number of sample meters by the consignee per lot for testing is subject to vary as per the latest IS on sampling.

If the number of defectives found in the sample of 32 is less than or equal to 1, the lot will be considered. If the number of defectives is greater than or equal to 4, the lot will be rejected. If the number of defective is 2 or 3 a further sample of 32 meters will be taken and subjected to the tests. If the number of defectives in two samples combined is less than 4, the lot will be considered as conforming to the tests, otherwise rejected.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

(b) Tests of insulation resistance, AC voltage test, Test of power consumption:- Tests of insulation resistance, AC voltage test, Test of power consumption, test of meter constant/registration, limits of error and interpretation of test results and adjustment.

From the sample of meters which have been drawn according to above clause 'a' and those that have passed all test of a sample of 8 meters shall be tested, all of which shall pass for conformity to these tests. If any one of the meters fails the whole lot shall be declared not conforming to the requirements of these test.

(c) Test of repeatability of Error:- Above tests shall be carried out on 3 samples selected from above meters under clause 'b' and shall be tested for repeatability of error test separately. If any one of the meters fails the whole lot shall be declared not conforming to the requirement of these tests.

If any lot fails, test at factory or at any TMR, normal sampling plan will be adopted at TMRs and double sampling plan will be adopted for test at factory for all future samples. It is specified below.

12.26 Double Sampling Plan:- For acceptance test, meters shall be selected at random from the lot, depending upon the size of the lot and the desired acceptance quantity level.

Double sampling plan for normal inspection given in IS: 2500 (part-1) /2000 shall be followed unless otherwise specified.

Generally applicable sampling plan is given below.

Lot size	sample	Sample size	Cumulative sample size	Acceptance No.	Rejection No.
281 to 500	1st	32	32	0	2
	2nd	32	64	1	2
501 to 1200	1st	50	50	0	3
	2nd	50	100	3	4
1201 to 3200	1st	80	80	1	3



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

	2nd	80	160	4	5
3201 to 10000	1st	125	125	2	5
	2nd	125	250	6	7

12.27 All sample of meters selected will be tested for no load condition, starting condition and limits of error.

12.28 For limits of error, minimum six metrological points as per table 15 and 16 of IS 13779

(preferably for current variation and carrying single phase load with a balanced polyphase voltage) shall be selected and one point will be considered as one characteristic test. Error limits have to be corrected for uncertainty of measurement. Any meter failing in any one of these tests shall be treated as non-conformity.

12.29 If the number of non-conforming meters found in the sample is less than or equal to acceptance number, the lot shall be considered to be conforming to these tests.

12.30 If the number of non-conforming meters is in between acceptance and rejection numbers, a further sample of meters will be taken and subjected to these tests. If the number of non-conforming meters in two samples combined is less than acceptance number of the second sample, the lot shall be considered as conforming to these tests, otherwise rejected.

12.31 From the sample meters passed the above mentioned three tests, a sample of at least 6 meters shall be tested for insulation resistance, AC Voltage and meter constant. All the meters shall pass for conformity to these tests. If any one of the meters fails in any of these tests, the whole lot shall be declared not conforming to the requirement of these tests.

12.32 After passing 12.31 Test for repeatability of error and power consumption shall be carried out on five samples that passed tests for no load condition, starting condition and limits of error. If any of the meters fails in any of these two tests, the whole lot shall be declared not conforming to the requirements of these tests and the lot shall be rejected.

12.33 Only on samples passed test of repeatability error and power consumption, additional acceptance tests are to be carried out. All meters should pass all these tests; otherwise the lot will be rejected.

C. Pre dispatch Inspection:-



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

12.34 All Acceptance tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase.

12.35 The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative(s) / Engineer(s) attending the above testing will carry out testing on suitable number of meters as per sampling procedure mentioned in this document and additional acceptance test as per this specification on samples that have passed all the tests mentioned in clause 12.22 and 12.24 and issue test certificate approval to the manufacturer and give clearance for dispatch.

12.36 All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection will be opened & resealed after inspection.

12.37 KSEB has the right to ask the supplier to furnish new type tests Certificate of sample meters, in accordance with Clause 12.13, at supplier's cost, at any time after completing supply of 50% of the ordered quantity. The sample for these tests will be selected from the quantity of meters already supplied. If the selected meters fail in type tests, KSEB has the right to cancel the purchase order for the unexecuted portion.

D. Inspection after Receipts at Store:-

12.38 Testing as per clause 12.25 (normal sampling plan) will be done at TMRs. Physical inspection and sealing also will be done at TMRs. If requested in writing the Chief Engineer (SCM) may permit the suppliers representative to witness the test at TMRs. If the sample/s selected, does not conform to the tests, lot will be rejected and no compensation will be given.

Physical verification:- The sample meters shall be verified for conformity of physical requirements such as RTC fail, push button fail, tamper indications, display fail, discrepancy in display, pulse fail, battery back ups, damaged body/ cover / terminal cover, non matching screws and threads, improper holes in sealing screws etc.

"On physical verification, if the samples selected vide clause No.12.25(a) are found to be defective, then, the clause No.12.27 should be read as "a sample of meters selected will be tested for no-load condition starting condition, limits of error and physical conditions."

12.39 No: of resubmission & rejection at each TMR:- The supplier shall be permitted to replace rejected lot only once in each lot in each TMR. Further rejection of replaced quantity will lead to deduction of the same quantity from the purchase order quantity. If the total deducted quantity is more than 20% of the ordered quantity, the KSE Board reserves the right to cancel the purchase order and to blacklist the firm.

13. Guarantee:-

13.1. The Three Phase four wire Energy meters with LCD and ToD facility should be guaranteed for a minimum period of five years from the date of acceptance of last part of the consignment by KSEBL. The date of expiry of



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

guarantee period will be intimated to the suppliers by the Chief Engineer (SCM) soon after the completion of full order quantity.

13.2. The meter found defective within the above guarantee period shall be replaced by the supplier free of cost, within three months from the date of receipt of intimation. The intimation shall be either by hand or by registered post/ courier with proper acknowledgement.

13.3 If defective meters are not replaced within the specified period as above, KSEBL shall

recover an amount equivalent to the cost of meter plus 15% supervision charges from any of the bills of the supplier. The amount so deducted will be refunded once the faulty meter is replaced after deducting the supervision charges.

13.4 At any case the overall failure rate of meter should not be more than 2.5% of the quantity supplied.

14. Quality Control:-

The purchaser has a right to send a team of experienced engineers for assessing the progress of manufacturing and quality at any time. The team should be given all assistance and cooperation for inspection and testing at the bidder's works.

15. Minimum Testing Facilities Required at Manufacturer's End

1. The following Manufacturing and testing facilities shall be available.

i. The factory shall be completely dust proof.

ii. The testing rooms shall be temperature and humidity controlled as per relevant Standards.

iii. The testing and calibrating equipment should be automatic and all test equipment shall have their valid calibration certificates

iv. Should have duly calibrated Electronic reference standard meter of class 0.1 or better accuracy.

v. Power supplies used in testing equipment shall be distortion free with sinusoidal waveforms and maintaining constant voltage current and frequency as per the relevant Standards.

vi. Should have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly without human intervention.

2. During the manufacturing of the meters following minimum checks shall be carried out.

a. Meter frame dimension tolerance shall be minimum.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

- b. The Voltage coil shall be made totally encapsulated and care shall be taken to avoid ingress of dust and moisture.
- c. The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
- d. The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.
- e. The current circuit shall be made with the help of jigs and fixtures.
- f. The voltage circuit shall be made with automatic computerized machine. Manufacturer should possess fully computerized Meter Test Bench System for carrying out all routine and acceptance Tests as per IS 13779/1999 (amended upto date) including additional acceptance tests specified in this document. Routine test reports for each and every meter and acceptance test reports for samples selected shall be generated and submitted for the approval of lot. One copy of test report, approved data sheet and operating manual shall be despatched with the meter
- g. Quality should be ensured at the following stages:
 - > At PCB manufacturing stage, each board shall be subjected to computerized bare board testing.
 - > At insertion stage, all components should undergo computerized testing for conforming to design parameters and orientation.
 - > Complete assembled and soldered PCB should undergo functional testing using Automatic Test Equipments (ATEs).

16. Quality Assurance Plan:-

The supplier shall invariably follow QAP furnished along with the bid. Precautions taken for ensuring usage of quality raw material and sub component shall be as stated in QAP.

The manufacturer shall have a comprehensive quality assurance program at all stages of manufacture for ensuring products giving reliable, trouble free performance. The manufacturer's quality assurance plan submitted along with bid document, would be reviewed in detail by the Board and modifications, as felt necessary suggested should be incorporated.

KSEBL reserves the right to carry out quality audit and quality surveillance of the systems and procedure of the quality management & control activities (including the sub contractors of the supplier). The firm shall provide all necessary assistance to enable the owner to carry out such audit & surveillance.

17. Component Specification:-



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Sl. No.	Component Function	Requirement	Makes
1)	Measurement or computing chips	The measurement or computing chips used in the Meter should be with the Surface mount type.	USA: Anolog Devices, Cyrus Logic, Atmel, PhilipsDallas, ST Germany: Siemens Texas, Japan : NEC Freescale, Renesas,
2)	Memory chips	The memory chips should not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit.	USA: Atmel, National Semiconductors, Texas Instruments, Philips, ST,Japan : Hitachi Germany: Siemens Renesas, ADESTO, ROHM
3)	Display modules	<p>a) The display modules should be well protected from the external UV radiations.</p> <p>b) The display visibility should be sufficient to read the Meter mounted at height of 0.5 to 2m from ground level. The LCD and ToD facility display should have wide viewing angle of 45 degree to 60 degree cone up to 1m distance</p> <p>c) The construction of the modules should be such that the displayed quantity should not disturbed with the life of display (PIN Type).</p> <p>d) It should be trans-reflective HTN (HTN – Hyper Twisted Nematic (120°)) or STN (STN – Super Twisted Nematic (160°)) type industrial grade with extended temperature range.</p>	<p>Japan : Hitachi, Sony. L&G, HajjingTinma (China)</p> <p>TEXAS RCL, Yeboo, Truly Semiconductors</p>



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

		HTN – Hyper Twisted Nematic (120°) STN – Super Twisted Nematic (160°)	
4)	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, Texas, Instruments, BC Component Japan : Hitachi, Oki, AVZ , Samsung Japan : Panasonic Germany : Vishay
5)	Battery	Only non rechargeable battery should be used for RTC, in absence of Power since the life & Reliability of these are better than the rechargeable batteries and for display both rechargeable and non rechargeable battery may be used. The RTC battery and battery for display in the case of power failure should be separate.	USA : Maxell Japan, Indonesia : Panasonic, Sony, Germany : Varta France : Saft Elegance , Vitzro, Tekcell, Mitsubishi EVE, Eternacell

Sd/-

CHIEF ENGINEER (SCM)



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

GTP of Three Phase, Four Wire, Whole Current 10-60A, Static Watt Hour Meter of Class 1.0 Accuracy with TOD facility

SI.No	PARTICULARS	PARAMETERS
	Type Model No.	Static ,Three Phase ,4 wire, whole current 10-60A meter with LCD and ToD facility.
	Standard/s to which the meter conforms	IS : 13779, IEC 62052-11, IS : 9000 & etc.
	Guarantee Period from the date of first Installation	5 years from the date of acceptance of last consignment by KSEBL
	Rated Voltage:	415V between phases and 240V between phase and neutral.
	Basic Current(Ib):	10 A
	Maximum Current(I _{max})	60 A (600% of Ib)
	Frequency Range:	50 Hz +/- 5%
	Power Factor Range	Zero Lag - Unity – Zero lead
	ISI mark	Yes
	Minimum Starting Current	0.2% of Ib at Unity Power factor
	Accuracy class for kWh and kVARh	for Kwh CL-1.0 for Kvarh CL-2.0
	Test Output device	Calibration LED
	Operation indicator	Yes
	Power consumption in voltage and current circuit	Voltage current <1.0 watt & 4.0 VA Current circuit <1.0 VA



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Limits of error at all Power factor of unity/0.5 at multiples of rated currents	As per IS : 13779
Change in error due	
Variation in frequency	As per IS : 13779
Variation in Temperature	As per IS : 13779
Variation in Voltage	As per IS : 13779
Variation in current	As per IS : 13779
Due to single phase current	As per IS : 13779
One minute Power frequency withstand Voltage	As per IS : 13779
Compliant to EMC & EMI	As per IS : 13779
Basic insulation level: Impulse withstand Voltage	As per IS : 13779
Current rating of the terminal	As per IS : 13779
External Magnetic Influence	As per CBIP Tech Report 325
Maximum size of cable, which can be connected at terminals	As per specification
Terminals to be bi-metallic and suitable for Aluminum / Copper Cables	As per specification
Maximum number of ToD zones that can be programmed and are programmed	8 zones (as per specification)
Integration period for MD that is programmed and can be programmed	30 minutes.
Whether programming of ToD and MD integration period can be done in the field using CMRI or Laptop	Yes



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

	If so, whether the facilities are having adequate security and if so, detail it.	Yes
	ToD wise kWh and kVAh	Yes
	Whether KVA, kVAR, KW, overall pf, MD reset count, frequency, time & date , RTC battery health parameters are available in data collection?	Inst. Power KVAR, KW & KVA combined (All the three phase)
	Terminal Block material	PBT
	Material for meter base and cover and whether the cover is transparent	Polycarbonate material & Cover-Transparent Base- Opaque
	Material for terminal cover and whether the cover is transparent	Polycarbonate & Transparent meter cover
	Resistance to Heat and Fire	Yes As per IS 13779
	Details of meter case	Poly carbonate
	Degree of protection against dust and water	IP 51
	Details of alpha-numeric LCD display	7 segment LCD display
	Display parameters available in auto scroll mode and display time of each parameter	As per specification
	Display parameters available in manual scroll mode and display time of each parameter	As per specification
	High resolution display parameters	As per specification
	No. of digits in the display	7 digits.
	Tamper protection features:	
	Voltage failure	Voltage failure
	Current Unbalance	Yes, available



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Current bypass	Yes, available
Current reversal	Voltage failure
Magnetic Logging	Yes, available
Any other	Yes, available
Whether test output provided	Yes, provided
Meter & Terminal Cover sealing	Yes, provided
Date of issue of Type Test Certificate/report	As per tender specification
Issuing authority of type test certificate/ reports	As per tender specification
Whether any changes in design from that type tested	No
Whether all type tests were conducted and all are on same design	Yes
Whether meter is designed with ASIC or microcontroller	Micro controller
List of bought out items which are used in the manufacturing of the meter	As per tender specification
Standard followed in Assembly of electronic components	Yes, Followed.
Suppliers of metering ICs and microcontrollers	As per specification
Whether the suppliers are STACK or IECQ registered suppliers	Yes
State of art technology used in the manufacturing and assembly	SMT
Provision for testing sub- assembled cards	Yes Available as per ISO & QAP



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram
Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

Details of volatile memory used	As per technical specification
Whether terminal cover is an extended transparent terminal cover	Yes.
Minimum clearance and creepage distance of the terminal block and those between the terminals and the surrounding parts	As per IS-13779
Whether RTC is pre-programmed	yes, through optical port
Life of RTC battery	10 years
Maximum drift of RTC per year	+/- 300 Seconds per year
Way of synchronisation of Energy Meter and 'RTC'	Through optical port
Life of Battery for display parameters	10 years
Whether meter terminals are marked	Yes
Connection diagram is provided and whether it is a sticker?	As per specification
Name plate details and whether meter serial number and bar code is given in the name plate	Yes, all as per specification
Meter base and cover jointing method	Yes, ultrasonic welding
Method adopted to transform voltage and current to the desired low values	As per offer
Details of factory programmable parameters	As per IS 15959
Details of user programmable parameters	As per IS 15959
Data communication facilities	Yes, Available
Whether All necessary software for down loading the information through CMRI will be supplied	CMRI and BCS software will be provided



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

Administered by TMRs | Kannur | Shoranur | Angamaly | Pallom | Thirumala

TECHNICAL SPECIFICATION

Three Phase Energy meter

Doc. #: **SCM-SPEC/XD/EM**

Rev.#: 0.1

Effective Date 11-6-2021

	without any additional cost?	
	Whether Energy meter have a galvanically isolated optical communication port as per IEC 62056-21?	Yes Available

Chief Engineer(SCM)