

SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

LT&HT Standard Reference Meters of Class of Accuracy 0.1

APPLICABLE TO KSEBL	Rev#0	DOC. NO.: SCM-SPEC/XD/Std Reference Meter
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Technical Committee

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2. Deputy Chief Engineer -SCM
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TECHNICAL SPECIFICATION

Standard Reference Meter

Doc. #: SCM-SPEC/XD/EM

Rev.#: 0

Effective Date 10.12.2021

(i) Document Approval & Control Status

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Date	10.12.2021	14.12.2021	16.12.2021
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(ii) Amendments and History

<i>Sec. #</i>	<i>Rev. #</i>	<i>Date</i>	<i>History of Change</i>



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1. Purpose

Purpose of this document is to document updates & history, upkeep and publish the specifications related to LT&HT Standard Reference Meters of Class of Accuracy 0.1 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 LT&HT Standard Reference Meters of Class of Accuracy 0.1 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



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TECHNICAL SPECIFICATION OF

HT/LT Standard Reference Meters of class 0.1 accuracy.

- Scope:** The specification covers the general requirement of design, manufacturing testing before despatch, supply and delivery of Portable Electronic Reference Standard Meter. It shall have provision for testing HT 3 Phase 3 Wire and 3 Phase 4 Wire meters and LT 3 Phase 4 Wire using direct mode for 1mA-12 Amp or with the help of clamp for 10mA - 120 A rating and 100mA - 300 A rating without disconnecting any wires at consumer premises..
- Application:-** The Portable Reference Standard Meter shall be suitable to perform installation checks, direct installation errors, load/ Harmonic analysis, Accuracy measurement and Dial Test on HT, LT, Direct current installation.

The function of the Portable Electronic Reference Standard Meter shall be suitable to measure the system parameters and verify the accuracy of three phase and single phase energy meters in the laboratory and at site without disconnecting consumers supply when used with the clamp - on CT.

The Portable Electronic Reference Standard Meters shall be extensively used in field & laboratory for verification of the accuracy of all types of three phase whole current, LT -CT operated, HT-CT operated and single phase energy meters.

The portable reference standard shall be capable to store all information, Customer information, Test information into its internal non-volatile memory.

3. **System Technical Data:-**

The Portable Electronic Reference Meter should have facility to power up from auxiliary power supply having voltage range of 85V to 265V and frequency range of 47 to 63 Hz. If connected to PT terminals it shall function without any external auxiliary power supply.

4. **Measurement Ranges:-**

The Electronic Reference Standard Meter shall be capable to perform measurement with:

1	Test voltage range	100 mV to 300 V (P-N)
2	Test voltage accuracy	< 0.05.%
3	Test current range in direct mode	1 mA to 12 A



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4	Test current range with external CT upto 120 A	10 mA to 120 A
5	Test current range with external CT upto 300 A	100 mA to 300 A
6	Test current accuracy in direct mode	< 0.05%
7	Test current accuracy in clamp on mode	< 0.15%
8	Frequency range	40 to 70 Hz
9	Phase angle measurement range	0 to 360 deg
10	Power factor	-1.000 to 0 to +1.000
11	Power/energy measurement error	0.1% (direct mode) 0.2% (clamp on CT mode)

5. **Service (Climatic Conditions):-** The equipment to be supplied against this specification should be capable of performing and maintaining the required accuracy for satisfactory operation under all tropical conditions mentioned below:

- Maximum ambient temperature - 50 Deg. C
- Minimum ambient temperature - 10 Deg. C
- Average daily ambient temperature - 40 Deg. C
- Minimum relative humidity - 25%
- Maximum relative humidity - 95%
- Annual average ambient temperature - 40 Deg. C.

6. **Standards Applicable:-** Unless otherwise specified elsewhere in this specification, the Portable Reference Standard Meters shall conform to relevant clause of the following standards in all respects including performance and testing thereof to the following Indian/ International Standards to be read with up to date and latest amendments/ revision thereof.

IEC:687: Alternating current static watt hour meters for Active Energy

IS:12346 : Testing equipment for AC Electrical Energy Meters.

IS: 14697: Alternating current Static Watt Hour Meters for Active energy measurements.



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IEC: 62052-22: Alternating Current static watt hour meters for active energy.

IEC: 9000: Basic environmental testing procedures for electronic and electrical items.

7. General Requirements:-

All the materials, electronic and power components and ICs used in the manufacturing of the equipment shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

The electronic component shall be mounted on PCB using latest surface mount technology (SMT).

The Electronic Reference Standard Meter shall be of rugged construction, light weight and shall be portable and handy. It shall be conveniently portable (Housed in a light weight design). It shall have ergonomic design.

Clamp-on CT along with a suitable connecting cable and a set of voltage leads with suitable crocodile clips which enable the testing without isolating or interrupting the supply of the consumer shall be supplied along with the Electronic Reference Standard Meter. Two sets of clamp CT (each containing 3 clamps and cable with adapter for each phase and cable with adapter for each phase suitably identified) of 0-12 Amp rating and 0-300 Amp rating shall be supplied.

An error calculator shall be incorporated in the Electronic Reference Standard Meter, which shall have facility to calculate error in percentage of meter under test by feeding the meter constant and number of revolutions for which meter was tested with Electronic Reference Standard Meter through the inbuilt key board.

The keyboard of the equipment shall be organized in form of alphanumeric matrix.

The Portable reference standard shall have TFT/LCD graphic display. The graphic display should be able to display voltage/ current waveforms along with network analysis features, harmonic and distortion analysis in graphic form.

Provision shall be made to indicate the energy flow direction.

The portable electronic standard reference meter should perform in the offered accuracy class at normal atmospheric condition. Also the influence of external magnetic field should not affect the offered performance of the meter.

8. Standard Rated Current and Maximum Current:- The Portable reference standard current range shall be with following specifications:

Direct Mode - 1mA to 12A

12A Clamp CT mode - 10mA to 12A



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300A Clamp CT mode - 100mA to 300A

9. **Measurement Mode:-** The offered equipment should have following measurement modes to test (accuracy test and Dial/ register test) HT/LT, CT operated Meters and direct connected type meters.

Direct Mode - To test HT/LT, CT meters, direct mode for 1A and 5A rating shall be provided on the equipment.

Clamp-on CT mode - Two types of clamp-on type current transformer (CT) shall be provided along with equipment to test direct connected meters without disconnecting them from circuit. One set for currents upto 12A (internal Diameter of clamp shall be 11 mm. maximum) and a suitable size for another set for currents up to 300 A.

1. Single phase two wire active, reactive and apparent.
2. Three Phase three wire active, reactive and apparent.
3. Three Phase four wire active, reactive and apparent.

The measuring mode shall be selectable using keyboard of the equipment.

The equipment shall perform

1. Load Analysis of the customer load: monitoring of voltage, current, power factor, Frequency, (Active, Reactive, Apparent) Power & energy.
2. Power Quality Analysis: monitoring of Voltage, Current and Power (Active, Reactive and Apparent) harmonics.

It should be possible to record and save results of all the tests: Accuracy/ Dial Test, Load Analysis and Power and Power Quality Analysis in its internal memory.

10. **Accuracy Requirement:** The class of accuracy for active reactive and apparent measurement shall be:

1. 0.1 (10 mA to 12 A) in Direct Measurement Mode.
2. 0.2 (500 mA to 120 A)/1A to 300A in clamp on CT Mode.

The Portable reference standard shall carry out accuracy test using built in error calculator with Scanning head suitable for testing Electronic as well as electromechanical meters. Scanning head should be able to pick LED/ LCD output in wavelength range 500-960 nm. The scanner should be fast enough to pick pulses of frequency as high as 500 Hz. The reference standard shall also be able to perform Dial/Register test to verify the energy registered by the meter under test.

11. **Display:** The display of the reference standard shall be of TFT/ LCD GRAPHIC monochrome type with resolution of 320 x 240 pixels. The display shall have size of 4" minimum to enable

display of voltage/ current wave forms in real time mode. The display should also have provision to render network analysis features like Vector and Harmonics along with distortion measurement.

The Reference Standard Meter shall display the following system parameters namely:

1. Phase wise voltage
2. Phase to phase voltage
3. Harmonic Distortion per phase and total harmonic distortion.
4. Phase wise current
5. Phase angle between voltages
6. Phase angle between voltage and current
7. Active, Reactive, Apparent Power and energy of each phase
8. Total Active, Reactive, Apparent Power and Power due to each harmonics
9. Instantaneous power factor for each phase
10. Total Power factor
11. Frequency
12. Phase Sequence
13. Wave forms of voltage and currents of each phase
14. Voltage and current vectors
15. Error in %
16. Integration Time.
17. Minimum size of screen should be 115mm x 88 mm
18. The display of the reference standard shall be of TFT/LCD GRAPHIC backlit with high resolution.
19. Continuous updating of energy (as per selected measuring mode) during error testing using scanner or snap switch.
20. It shall have additional feature of back lit facility.

12. **Display Resolutions:-** Minimum resolutions of various parameters shall be as follows:

1. Voltage - 0.01 mV
2. Current - 0.0001 (1A), 0.001 (5A), 0.01 (100 A), 0.1 (300 A)
3. Power factor - 0.001.
4. Energy - 0.0001 (Wh)
5. % Error Resolution - 0.001

13. **Automatic Checking of connection:-** The equipment TFT/LCD graphic display shall be capable of indicating display for the following conditions

1. Missing potential
2. Missing current
3. Reverse current if any current is reverse.
4. Phase sequence "Forward or Reverse"
5. Wrong phase Association.

6. Over current.
7. Over voltage using graphic Vector display on its TFT/ LCD Screen

14. **Memory:-** The Reference Standard Meter shall have the facility to store minimum 400 test results along with following instantaneous parameters:

1. Voltage of each phase
2. Current of each phase
3. Angle between voltage & current
4. Power – active, Reactive & apparent per phase & total
5. Measuring mode/Test configuration
6. No. of revolution
7. MUT constant
8. Error in percentage
9. Power factor per phase & total
10. Total Harmonic distortion of V & I per phase
11. SI. No. of Meter Under Test (MUT)
12. SI. No. of reference mater
13. Date & Time of Testing
14. Location of meter, Substation & Feeder details
15. Customer Name
16. Meter Description
17. Voltage & Current Vectors
18. Name of Operator
19. Space to sign operator/verifier on test report
20. Facility to view the stored test result on screen and to download the same into the PC shall be provided. Equipment should have facility to indicate memory status in percentage of free and used memory.
21. Offered equipment shall have facility to view/monitor/record system parameters during performing the error testing, dial testing, Energy Register testing, Power (demand) registers testing. This facility shall be provided without disturbing the running test so that any variation in system parameters can be observed by operator.

Reference Meter shall be designed to include memory management function to include deletion, insertion and viewing of saved Data without the use of external PC.

The manufacturer shall supply suitable WINDOWS based application software to download results from internal memory of the reference standard. The software should have function to download data from the reference meter and present the data in a neat format. It should be possible to transport the downloaded data into any standard software like MS-EXCEL. The software shall have function to archive, store the downloaded data into the PC.

15. **Interface:-** The reference meter should have interface provisions.

- Scanning head input to allow counting of pulses from scanning head.

- Data communication port (for interfacing laptop) should be optical/USB supported to allow uploads/download of information from/ to portable reference standard
- Remote snap switch to count pulses.
- Scanner which can sense a blinking LED/LCD & rotor mark
- High resolution electrical Pulse output to allow testing of portable standard against reference standard of higher accuracy.
- Data Storage on removable compact flash memory card or by any suitable means.
- To perform dial test in auto mode
- The optical scanner head should be capable to evaluate the error through calibrating pulses output of electronic meter & Red/Black mark on the Rotor disc of electromechanical meter.
- Error compensated clamp-on CTs of class 0.2 (up to 300 A).
- Frequency output to calibrate the reference standard itself. The equipment shall have one BNC socket to capture frequency output.

16. **Safety Requirements:-** The Electronic Reference Standard Meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal working conditions, so as to ensure especially

- Personal safety against electric shock preferable as per IEC61010-1;2002.
- Personal safety against effect of excessive temperature.
- Safety against spread of fire.

All parts, which are subject to corrosion, shall be suitably protected and the protective coating shall not be liable to damage by normal handling. The sealing effectiveness of electrical enclosure against intrusion from foreign bodies and moisture and the degree of protection against dust and water shall preferably be as per IP56. The equipment shall be protected against fraud and tampering.

17. **Case:-** The Electronic Reference Standard Meter along with all the accessories should be housed in a suitable rugged plastic case and any non-permanent deformation of the case shall not affect the satisfactory performance of the equipment. Electronic Reference Standard Meter should be conveniently portable (housed in a light weight casing)

18. **Power Consumption:-** The active power consumption of the Electronic Reference Standard Meter at reference voltage, frequency, temperature and rated current shall not be more than 10 VA per phase mode or 25 VA in 3 phase mode in voltage circuit excluding the leads.

19. **Carrying Case:-** Each Electronic Reference Standard Meter shall be supplied in a Aluminum carrying case suitable for easy portability, rugged use and to prevent damage during transit. The Electronic Reference Standard Meter should be immune to vibrations and shocks in normal transportation and handling.

20. **Software:-** Each Electronic Reference Standard Meter shall be supplied along with PC Software. The software shall be suitable for downloading the test results into IBM compatible PC. The software shall have facility to generate the test report for individual testing and summary report of all test reports. A full and accurate test report detailing the equipment make, model number, accuracy class, equipment ID, date, time, test meter details, premises details, CT ratio, etc. is necessary to produce before various fora.



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The software used should be user friendly, latest version (updated) and should be compatible for testing all types of HT/LT energy meters. The equipment should be capable of communicating directly with laptop computers. All software modules compliant with Microsoft Windows and latest operating system should be provided.

Provision for entering consumer CT ratio, voltage etc. directly so that it can be readable by the consumer.

The offered software shall have facility to transport all stored test results in another file format like MS EXCEL. The offered software shall be user friendly and menu driven. The supplier shall impart necessary training regarding installation and use of the above software.

21. **Accessories:-** Every Electronic Reference Standard Meter shall be supplied along with following accessories:

- Common optical sensor for automatic testing, which can be used to sense disc revolutions in electromechanical meters as well as indicating LED and LCD pulses in static meters and compatible with all the meters.
- Mounting arrangement (clamp) for the optical sensor.
- Two sets (each set containing 3 clamps and cable with adaptor for each Phase suitably identified) of Clamp CTs of 0-12 A and 0-300 A shall be supplied. Also suitable cables for interlinking terminal shall be supplied.
- A set of voltage leads with insulated clips (4 Nos.- Red, Yellow, Blue, Black).
- Current leads to connect Electronic Reference Standard Meter in direct mode (1 set of 6Nos. – 2 Red, 2 Yellow, 2 Blue).
- set of clips and connectors each consisting of
 1. Cable Adapter/ Connection Pins – 10Nos.
 2. Voltage Adapters – 4 Nos.
 3. Banana Clips (Straight) – 6 Nos.
 4. Banana Clips (Bent) – 4 Nos.
 5. Crocodile clips – 3 Nos.
 6. U clips – 6 Nos.
- Serial communication cord with RS232 connector to retrieve stored data from the Electronic Reference Standard Meter and download the same to a PC.
- Snap switch along with cable.
- Base Computer Software (BCS).
- Operating Manual and Calibration Report.

22. **Guarantee:-** The equipment offered shall be guaranteed for performance for a period of 60 months from the date of acceptance by the consignee. Any defective or damaged material shall be replaced by the supplier free of all costs to the KSEBL and to the full satisfaction of the Board within one month from the date of receipt of intimation. The equipment should have a design life not less than ten years.



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23. **After Sales Support and Training:-** The supplier shall arrange to provide free training at places as desired by the purchaser for use of Electronic Reference Standard Meter and base Computer Software. The supplier shall provide competent and timely after sales service support without any extra cost through their in-house technical experts or experts from the original manufacturer.
24. **Packing and Forwarding:-** The equipment shall be packed suitably in crates/ cartons suitable for vertical/ horizontal transport as the case may be and suitable to withstand handling during transport and outdoor storage during transit.

Each consignment shall be accompanied with a detailed packing list containing the following information.

1. Name of the Consignee.
 2. Details of Consignment.
 3. Destination.
 4. Handling and Packing Instructions.
 5. Bill of material indicating contents of each package.
25. **Documentation:-** All the required documents/ drawings shall be furnished by the supplier. All dimensions and data shall be in S.I Units.
- i. Catalogues describing the equipment and indicating the type and model number.
 - ii. Operating manual describing the operational feature of the equipment and PC software.
26. **Demonstration:-** The supplier has to demonstrate quality/ functioning of Electronic Reference Standard Meter before KSEBL's Technical Committee for testing of meters on specified date within 10 days on a written request by KSEBL. Accordingly, supplier should make all necessary arrangements to demonstrate general quality and live functioning of the reference meter.

Sd/-
CHIEF ENGINEER (SCM)

Guaranteed Technical Particulars of Electronic Reference Standard Meters (ERSM) of class 0.1 for testing of HT/LT Meters.

1.	Name of manufacturer	
2.	Make	
3.	Type, design/ model No.	
4.	Auxiliary power supply range	46 V – 300 V, 1- phase 47 Hz - 63 Hz
5.	Test Voltage	0-300 V, P-N.
6.	Test Current a. Direct mode b. Clamp on CT mode	1 mA to 12 A 10 mA to 120 A in UCT 120.3 clamp 1A to1000 A in UCT 1000.3 clamp
7.	Test Frequency	40 to 70 Hz
8.	Accuracy class for active, reactive and apparent measurement	0.1 S class for active, reactive and apparent mode (In direct mode) 02.S class for active, reactive and apparent mode (In CT mode)
9.	Functions	<ul style="list-style-type: none"> • Test of energy meters of accuracy upto 0.5S in CT mode • Test of energy meter of accuracy class upto 0.2S in direct mode. • Voltage, current and power harmonics display in real time waveform and histogram. • Archiving of test results along with customer and test information in internal memory.
10.	Display Size	7", 800x480 pixels, coloured TFT with touch screen.
11.	Total weight & size	230x159x58 mm including rubber protection. Weight 1.1 kg including rubber protection.

12.	Measuring Mode	3 phase 3 wire 3 phase 4 wire Active, reactive and apparent power and energy. Single phase Energy meter calibration.
13.	Vectorial and wave Display	Provided on coloured TFT graphic screen.
14.	Frequency Output	High frequency pulse output provided.
15.	Power Quality Measurement	Voltage harmonics and THD display Current harmonics and THD display Power harmonics and THD display.
16.	Data Storage	1 GB data storage in SD card media.
17.	Software	CA Legration software for downloading, archiving and printing of test results.
18.	Scanning Head	SH 2003 scanning head with support and impulse cable for test of Electronic and mechanical meters.
19.	Standard Accessories	<ul style="list-style-type: none"> • Voltage cable with adaptors - sets of 4 • Current cables with adaptors - sets of 6 • Hand switch – 1 No. • USB and RJ 45 communication cable for data download – 1 each • Engineering plastic transport case -1 • CA Legration software with licence – 1 No. • 12A CT Clamp • 120 A CT clamp • 1000 A CT Clamp set • Optical sensor SH 2003 • Clips and connectors • Operation manual and calibration certificate.
20.	Interchangeability	Yes, electronically compensated CT clamp set for interchangeability.
21.	Guarantee period	60 months from the date of delivery to KSEB and training programme.

Sd/-
CHIEF ENGINEER (SCM)