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HANDY CALIBRATION UNIT WITH ALL STANDARD RIGHTS & CERTIFICATIONS TO GIVE SERVICE TO CLIENTS FOR CALIBRATION OF METERS ONSITE AT INSTITUTE LEVEL TO ECONOMIZE EXTRA CHARGES EXPEND ON OTHER CALIBRATION LABORATORIES

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ABSTRACT

Although the word "calibrate" is only a few hundred years old, the concept of calibration is far older. In today's research labs, calibration is frequently employed to assure correct results. So we present in this paper, the design of a “Handy calibration unit for calibration of meters onsite to economize extra charges expend on other calibration laboratories”, in which we proposed a method to calibrate meters remotely and onsite. The meters are analyzed on our module which are to be calibrated or not, based on a current or voltage reference value. These references should be generated by a power source & vary with variable loads. For dc meters, the converter is used to convert the voltage coming from the electrical network, which can vary, to a reference voltage that is stable and known, while the AC or DC load is used to set the current value. Stakeholders and service providers in the metering sector who are responsible for sustaining metrological and functional performance of ac power meters through their long unattended useful life, including testing, assessment, installation, and maintenance. The goal is also to build a performance-based good meter asset management plan, which includes identifying and removing problems in a timely manner, as well as repair, re-certification, and re-verification at academic institutes without charge.

Keywords: Remote Calibration, Voltmeter, Ammeter, Wattmeter, Frequency Meter, Energy Meter, Less Charge Of Calibration, Institute Level Service Onsite.

I. INTRODUCTION

One of the most common calibration services provided by calibration laboratories is meter calibration. The purpose of calibration, or the goal of calibration, is to reduce measurement uncertainty by assuring test equipment accuracy. Calibration is the process of quantifying and controlling mistakes or uncertainties in measuring processes to a safe level. Calibration is required to establish and verify metrological traceability, as well as to confirm that readings from the instrument are compatible with other measurements. So we imagine a concept to reduce cost of calibration which is done yearly in institutes by making a handy unit with the authorized license to give service to clients.

II. METHODOLOGY

Aims & objectives

1) Saving money

Calibration helps to prevent inaccuracies that might add up over time. Whether you work in a research lab or a manufacturing plant, mistakes can happen. Manufacturers who do not calibrate their equipment, for example, will end up with faults that result in worthless products. Without calibration, research labs risk producing nonsensical results based on faulty measurements. When inaccuracies are identified, you'll have to stop and restart processes if you don't calibrate. The longer those problems go unchecked, the more costly the mistake becomes. You won't have these issues if you always calibrate.

2) Improving safety

In certain labs, safety becomes a top priority. You could be working with potentially hazardous products or developing medicinal treatments. Small inaccuracies can have a big impact in these situations. Perhaps you're attempting to measure electric currents or combining volatile compounds. Small adjustments to the figures might easily put your employees in jeopardy. Calibration enables you to obtain accurate data for increased safety.

3) Giving meters as certified

In several sectors, calibration is required to obtain certification. For example, regulatory agencies may require certification before you can perform specific jobs. Calibration is crucial even if you don't need certification because of the consistent outcomes it provides. If you work with uncalibrated equipment, your reputation for study or outcomes will immediately suffer.

4) Keeping instruments working longer

Any measurement device's accuracy degrades with time. Some instruments deteriorate at a faster rate than others. The environment in which the equipment is used might also have an impact on how rapidly it degrades. When you calibrate your equipment, you restore it to its original state so that you can continue to use it. It's unlikely that the equipment that's giving you false readings needs to be replaced; instead, it only needs to be calibrated.

5) Onsite calibration

To calibrate your instruments, you'll need to take them out of the lab and have them examined by calibration experts. They can also make changes to your research tools if necessary. They'll return the equipment with a report detailing the measurement mistakes they discovered and how they were reduced after calibration. To avoid that we can give service onsite with our unit. So to clients or customers have not to transport meters at the labs.

Meter testing & calibration facilities in laboratories in India

The Apex test and calibration laboratory in India is the National Physical Laboratory (NPL) in New Delhi. Other government departments, such as the Ministry of Power and the Ministry of Information Technology, are in charge of similar laboratories. The National Accreditation Board of Testing and Calibration Laboratories (NABL) in India has accredited the majority of them. Each of them, however, specializes in different areas and provides services for a variety of products. It is necessary to visit numerous laboratories for thorough type checks on energy meters, and the wait period is usually significant. These laboratories are able to provide calibration of power and energy reference equipment, as well as other electrical parameters, with different best measuring capabilities. In the private sector, there are just a few laboratories, most of which provide calibration services for general-purpose equipment or class 1 or 2 energy meters. Only one laboratory in the private sector has Indian (NABL) and international (UKAS) accreditation and provides full type test and calibration services for meters, as well as calibration of instrument transformers and other power and energy reference equipment. Many utilities have their own meters testing labs, which are often equipped with transformer-powered manual or semi-automatic test benches as well as certain portable test tools. Many laboratories still use old Rotary Sub standards, although a few utilities have modernized in recent times by the introduction of modern automatic test benches and electronic portable test/calibration instruments. These have been supplied by Zera in Germany, MTE of Switzerland, and SML, an Indian manufacturer. However, the significance of NABL accreditation has not been properly acknowledged, and only two or three private utility meter test labs are working toward this accreditation. To raise customer confidence, these labs require considerable improvements in test equipment, operational conditions, staff training, and overall quality management, and it is concerning that nothing is being done to address this. Although the Bureau of Indian Standards maintains several laboratories, they are not prepared to test and calibrate static meters, hence the Bureau relies on the services of other labs. There isn't a single meter manufacturer that has a NABL-accredited calibration lab. For inside inspection of energy meters, utilities frequently use their own internal meter test labs. Some utilities, however, have begun to utilize the services of either their own meter test/calibration labs or externally accredited labs for the independent assessment of the quality of sample batches of meters as part of their purchasing process. The meters are then subjected to a subset of type tests, either before or after purchase decisions are made. This is an excellent move that will assist utilities in ensuring that the meters they have ordered satisfy quality standards. Most utilities, on the other hand, still prefer to use exclusively government laboratories. This must change; utilities must acknowledge and establish faith in the importance of NABL accreditation, as well as offer other labs an equal chance. [1]

How do instruments lose accuracy over time?

The most significant factor impacting instrument accuracy is physical mechanical wear and tear. This can take the form of oxidized connections, fine particle pollution, and physical wear produced by the repeated insertion and removal of test leads in test lead sockets. All of these difficulties can cause the leads to become loose in the socket, preventing the tester from keeping its null value and causing readings to vary. In terms of internal components, relays and rotary switch assemblies are essential. High actuation relay components are prone to burning and contamination, resulting in reading fluctuation, while daily impacts can weaken and damage mechanical relays or small surface mount components that are destroyed by bigger components knocking against them. [2]

What are the most important factors that influence accuracy?

It's hard to list all of the variables that impact accuracy from one moment to the next, but environmental circumstances are very important. Manufacturers specify an ideal temperature for storing testers, and though this is impossible to achieve in practice, when instruments are left in severe conditions - such as freezing vans overnight - they will read less reliably. Specific tests can also have an impact on accuracy. The heat generated by repeated high current loop testing, for example, will condense the air inside the tester, affecting results. As a result, knowing the instrument's specifications is a smart idea.

Why should calibration be annual?

An annual calibration is recommended to see how far a machine has strayed from its factory-adjusted settings over the course of the year. In the meanwhile, utilizing a checkbox to evaluate a unit's function is advised, similar to how a motorist checks oil, water, and tyre pressure before driving a long distance. A quality checkbox is a valuable technique of validating the testers' accuracy. Experienced electricians can typically notice a dubious reading, but there is always some ambiguity about whether the tester is reading accurately. The discrepancy between the value applied to the device and the actual reading displayed by the tester will be reflected in the calibration certificate. Manufacturers offer a tolerance for each of the tester's functions since the unit seldom reads the exact value applied by the calibrator.

How does the calibration process work?

Instruments are stored in a temperature-controlled environment before calibration so that the air within the device is the same temperature as the surrounding air. Sockets and plugs are also cleaned of any obvious contaminants. The tester will subsequently be connected to calibrating equipment, with the end user's test leads being preferred. Otherwise, laboratory test leads will be used, and the final certificate will state such. A sequence of values will be applied to each of the tester's functional settings, progressing from the lowest to the highest point in the measurement range. Then it calculates a pass or fail result by comparing the variation in the given and displayed data to the allowed tolerances. If the item fails, it will be modified according to the manufacturer's processes and tolerances to bring it back into specification. A calibration certificate will be produced and anti-tamper seals will be placed to the unit once the readings for all applied values obtain a pass result and the equipment meets the standards set out in the manufacturer's specification.

Systematic error

On repeated measurements of a given quantity, these are the errors that remain constant or fluctuate according to a specific law. These inaccuracies can be analyzed, and their impact on measurement findings can be reduced by implementing suitable rectification. Systematic errors can divided in two categories:

- Instrumental error
- Environmental error

Because of their mechanical structure and calibration or operation of the apparatus utilized, measuring instruments have inherent inaccuracies. Friction in bearings of various components, for example, might produce inaccurate readings in D'Arsonval movement. A similar result is caused by incorrect zero correction. Instrumental mistakes can also be caused by poor construction, uneven spring tensions, and fluctuations in the air gap. Calibration errors might cause the instrument's reading to be too low or too high. Instrumental errors can be prevented by doing the following:

- Choosing the most appropriate measuring device for the application
- Calibrating the measuring device or instrument with a standard

• After evaluating the extent of instrumental mistakes, correction factors are applied.

Environmental faults are far more difficult to deal with since they alter over time in an unpredictable way. These errors occur when an instrument is used in conditions other than those in which it was manufactured and calibrated. Temperature changes affect the properties of materials in a variety of ways, including size, resistivity, spring effect, and many others. Humidity, altitude, the earth's magnetic field, gravity, stray electric and magnetic fields, and other environmental factors all influence the results provided by the instruments. These errors can be reduced by taking the following precautions:

• Use the measuring equipment in the same environment that it was manufactured and calibrated in.

• If the aforementioned precaution is not achievable, the variation in local conditions must be determined, and appropriate compensations in the instrumental reading must be applied.

• It is also conceivable to use sophisticated technologies to do automatic adjustment for such deviations.

Testing, evaluation, installation and maintenance of electricity meters as per Indian standards

1) Introduction

This Code outlines informative requirements and good guidance for various stakeholders and service providers in the metering industry who are responsible for maintaining metrological and functional performance throughout the long unattended period of useful life of ac electricity meters, including testing, evaluation, installation, and maintenance. The goal is to develop a performance-based good meter asset management strategy. This code covers the following aspects: Type approval; Life certification; Verification; Sealing and seal management; Acceptance; Transportation; Storage; Installation and commissioning; Maintaining in-service with emphasis on in-service; Compliance; Meter test station practices. This Code also deals with: Identification and removal of defects in reasonable time; Repair; Re-certification and re-verification; Disposal. Statistical sampling approaches are commonly used to conduct in-service compliance testing of meters for low and medium voltage applications, allowing metering providers to determine relevant action plans for varied meter populations. At present sampling by attributes has been preferred. High-voltage meters may be submitted to a thorough examination. The model recommendations and practices are given with special emphasis on: Correct and proper installations; In-service surveillance; Safety measures; Testing at various stages; Standards for meter testing and periodicity of calibration; Concept of certified life; Requirements for in-service compliance testing; Performance based meter asset register.

2) Terminology

In addition to the definitions supplied in the relevant standards, the following definitions shall apply for the purposes of this standard.

2.1) Type approval - The first step in a conformity assessment procedure, in which a notified body examines the technical design of a prototype meter, either independently or with the assistance of an established meter testing laboratory, and ensures and declares that the technical design denoted by the approved type complies with the relevant standard's requirements.

2.2) Verification & certification - The portion of a conformity assessment method in which a recognized body ensures the conformity of production batches of meters to the authorized type on a continuous or periodic basis.

2.3) Useful life & Reliability & Dependability & Durability & Error (of a meter)

2.4) Uncertainty - A range of values within which the true value is estimated to lie is described by an estimate linked to a test result.

2.5) Limits of error - Within which a meter's metrological performance must be maintained or checked under reference conditions as stipulated by the appropriate metering standards, taking into account the measurement uncertainty of test results.

2.6) Maximum Permissible Error in-service (M.P.E.) - For a specific meter in service under rated operating conditions as described in relevant standards, the maximum value of an error authorized by this Code or national rules.

2.7) Certification sealing - The procedure of affixing characteristic seals on a meter as a mark of verification by a notified entity and keeping suitable records for traceability of the asset and the equipment used to seal it. The goal of sealing is to keep meter elements and the register secure.

2.8) Installation sealing - The practice of affixing characteristic seals to a meter, metering equipment, and installation in order to create evidence of illicit metering system access.

2.9) Primary packaging - The packing that surrounds a product right away. From the moment it leaves the supplier's site until it is installed, it provides the majority of the strength and moisture, vapour, or grease barrier required to protect the meter's performance and functionality.

2.10) Secondary packaging - The primary package is placed inside the outer package. Its main purpose is to keep the meters safe while they are being shipped and distributed.

2.11) Asset register - A system for registering metering assets of a licensee, whether electronic or not, and documenting various facts connected to inprocurement, usage, status of in-service compliance, repair, reuse, and destruction for the purpose of traceability.

2.12) Accredited laboratory - The laboratory is accredited as per IS/IEC/ISO 17025 and is part of a national / international calibration chain that can be traced back to primary S.I. benchmarks.

3) Type Approval

3.1) Introduction - The method of a notified entity determining conformity of a meter type with the applicable standard is briefly described below.

3.2) Methodology -

3.2.1) The notified body, in general, determines the method of type approval and the quantity of prototype samples. The samples, on the other hand, are drawn and submitted by the manufacturer, along with the essential documentation and details –

a) Type designation;

b) Meter rating details;

c) Drawing of nameplate;

d) Metrological characteristics include: a description of the measuring principle; a metrological specification; and, if applicable, any hardware changes; and

e) Block diagram with fictitious descriptions of components and devices; Drawings, schematics, and general software information detailing the design; Sealing arrangement and protective devices; and Data for dependability/durability features for life estimation (including possible software aspects in future).

3.2.2) Type approval is accorded by the notified body and a certificate is issued after -

a) Type testing are completed satisfactorily;

b) The documentation's type particulars have been investigated and recorded;

c) Based on the manufacturer's report, the consistency of production feasibility has been checked and assured; and

d) Dependability qualities have provided a minimum life of up to ten years.

3.3) Validity of approval - The approvals are usually valid for a duration of ten years. It may continue till the end of the meter's useful life if it has a verified life.

4) Amendment

If the manufacturer reports a deviation from the approved type, a new type approval will be granted based on a limited inspection, including limited type tests relating to the alteration (s). The type approval authority will determine the scope of testing.

5) Life certification

A notified body normally assigns a useful life to an approved type of meter based on one of the following criteria.

5.1) New type of meters -

a) Durability is predicted based on the projected reliability of components provided by the manufacturer at the design

stage; and

b) Prototypes are subjected to accelerated durability testing.

5.2) Existing type of meters -

a) By gathering field data on reliability;

b) By seeing the field's removed meters; and

c) As part of an ongoing compliance programme, a sample survey of meters in service was conducted.

6) Verification

The purpose of the verification procedure is to give users and energy service providers a high level of confidence. It covers the following objectives:

a) Maintaining a quality management system for meters of the approved type by the manufacturer, including regular audits and periodic surveillance by a notified organization;

b) Regular audits of meters awaiting dispatch after production for metrological verification to demonstrate compliance to the approved type using statistical sampling by characteristics with AQL = 1 and periodic surveillance of the manufacturer by a certified authority;

c) Periodic type testing on manufacturer samples collected by a notified body based on a limited set of tests to

demonstrate compliance to the authorized type; and

d) As specified in this Code, metrological verification of the manufacturer's meter test equipments (M. T. Es).

NOTE - The Bureau of Indian Standards (BIS) administers the B1S Certification Marks Scheme in line with the BIS ACI, 1986 and the Rules and Regulations promulgated thereunder, which partially addresses the aforesaid objectives. It is not, however, the notified body.

7) Verification sealing

After the creation of a meter on behalf of the notified entity, one or more distinguishing seal(s) are attached as proof of certification/verification. The following are the characteristics of seals:

a) Authorized representatives of the informed body typically use this method. Members of the manufacturing company

may serve as such representatives, but they must be qualified by the notified authority;

b) Metal ferule and stainless steel wire to be punched, polycarbonate self-lock or adhesive sticker with hologram;

c) Provided with manufacturer-specific alphanumeric characters and a unique traceable number;

d) The notified body registers approved manufacturer-specific alpha numeric characters; and

e) Traceable, if necessary, with documentation.

8) Acceptance

8.1) Introduction - The buyer is responsible for accepting the meters that a supplier has supplied for delivery. Test results that match the manufacturer's quality assurance representative's normal test schedule for the applicable metering standards must be given with the meters given for acceptance. The point of acceptance of goods can be the supplier's, the customer's, or any other location mutually agreed upon by the buyer and the supplier. This is usually determined by the contract's economic nature, as well as the availability of suitable acceptance testing facilities and logistics. A tiered acceptance process involving a pre-acceptance at the supplier's location and a final acceptance at the purchaser's location may be used in some instances. The purchaser's representative will oversee and certify the acceptance test method. The buyer can use its own staff, a third party, or skilled individuals from the supplier company. Meters must be accepted either on a 100 percent inspection basis or on a sample inspection basis, as agreed between the supplier and the purchaser. The tests must follow the acceptance test schedule stated in the appropriate Indian metering standards, namely IS 13010, IS 13779, and IS 14697. Any extra physical and functional verification tests can be performed if both the supplier and the purchaser agree. The manufacturer must seal the meter and it must be tested without breaking or opening the manufacturer's characteristic (warranty) seal.

8.2) Inspection reporting - The inspection observations report must include detailed information on the serial numbers of the Iots inspected, the lot size, the serial numbers of the sample meters, the inspection date, and the identity of the inspector. The report must include a categorical description of observations as well as the outcomes of the tests listed in the test schedule above. If a test is skipped or not performed, the rationale for doing so must be stated. The designated authority must clear the lot based on the inspection report. The competent authorities may take appropriate action if the lot is not accepted.

9) Packaging and transportation

9.1) Packaging of meters - The meters must be properly packed to guarantee that they are transported, handled, identified, and stored safely from the manufacturer's facility to the installation site. All packing materials must be environmentally friendly and comply with all applicable environmental laws and regulations. Avoid using non-recyclable materials such as polystyrene (thermacol).

9.1.1) Meters' primary packaging must protect them from moisture, dust, and grease, as well as assure their performance and operation until they are installed.

9.1.2) Meters should be packaged in secondary packaging to safeguard them during transport and distribution. The following shall be ensured -

a) Meters must be packaged properly, for as in corrugated cardboard containers;

b) The number of meters in each cardboard carton will be determined by the ease with which it may be handled;

c) The fragile nature of the contents and the direction of placement of the box must be indicated on the packing boxes.

Each packaging must clearly identify the marking details of the consignment as agreed between the supplier and the

purchaser (for example, manufacturer's name, serial numbers of meters in the box, amount of meters, other details

as agreed, etc); and

d) Any further packaging or labeling needs, if any, must be agreed upon between the buyer and the supplier.

9.1.3) Tertiary packing - The tertiary packing of meters ensures that they are protected throughout transport. Appropriate measures must be made based on the form of transportation, the distance travelled, the quantity and type of meters used, and the consignee's geographic location. Some modes of transportation may necessitate special packaging considerations (for example, pallet sizes, handling and lifting provisions).

9.2) Transportation of meters - During shipping, care should be taken to ensure that meters are not subjected to undue shock or maltreatment. The stacking of the package boxes within the transporting media should be done in such a way that they do not move around freely inside. The transport media should also protect the packaging from rain and dust.

10) Repair

A meter is removed at the end of its useful life, taking into account all extensions, or at the end of the in-service compliance term. The following step is either refurbishing or repair in the service provider's, manufacturer's, or third-party workshop. Otherwise, it can be discarded. The decision was made based on economic factors that included:

a) Remaining useful life after repair;

b) Cost of repair; and

c) Asset disposal value.

11) Re-Certification / Re-Verification / In-service Re-Compliance

Following the refurbishment/repair of meters that have been pulled from service, it is a good practice to:

a) For the remainder of its useful life, the notified body must recertify it;

b) The seals were applied once the notified body re-verified them; and

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c) Inspected for re-compliance testing and re-compliance time in-service.

12) Disposal

Meters must be disposed of in a systematic manner at the end of their useful life, when they become obsolete, or when they are considered irreparable or uneconomical to repair within their service life. Such meters must be dismantled and disposed of in such a way that no reusable or recyclable parts remain. Meter identification plates/labels must be destroyed and entered into the asset management system. Hazardous materials/components, such as lithium batteries, magnets, lead-containing parts, and so on, will require special disposal procedures.

13) Asset and seal management system

13.1) Asset management - To ensure that the life cycle history of meters can be traced from the moment of first installation, an asset management system must be maintained for keeping records. Meters shall only be issued against the consumer number/consumer name issued from the stores, and the information of the consumer number/consumer name and address against which the meters are issued shall be retained in the stores. The register must include information about the meter serial number, the serial number assigned by the energy service provider, the procurement reference (for example, purchase order number), the sealing details, the manufacturer's name, the year of manufacture, the type of meter, the meter constant, the accuracy class, the current rating, the installation site reference, and the date of installation, initial reading, information on auxiliary equipment such as CT/VT and their ratings, test results or references to test results (accuracy test, dial test). The asset register should preferably be electronic, with characteristics that allow for the traceability of the metering installation's history. The initial and ongoing status of compliance should be recorded in the register using sample test results. Records of returning meters must also be kept. When an old meter arrives at the store, all of the information about it must be input into the register.

13.2) Seal management - The energy service provider must keep a proper seal management system in place. Seals are secure, managed, uniquely identified, and traceable thanks to the seal management system. The following must be ensured by a seal management system:

a) Each manufacturer/energy service provider's seal is different and unique;

b) Seals are difficult to imitate;

c) When seals are removed, they leave visible evidence;

d) Seals are tracked from procurement to inventory, issue, installation, and disposal;

e) A responsible individual should be able to trace the traceability;

f) Consumers can be identified by meter numbers on all numbered seals;

g) Seals are protected from being tampered with;

h) When utilized, the sealing punch must be distinctly recognized and traceable; and

i) The Seal Management system is safe and secure, with strict access restrictions.

Consumers should be able to trace all numbered seals back to their meters. All broken seals must be disposed of, with special care taken to ensure that the seals are destroyed and cannot be used again. It is necessary to keep accurate records of such disposal.

III. MODELING

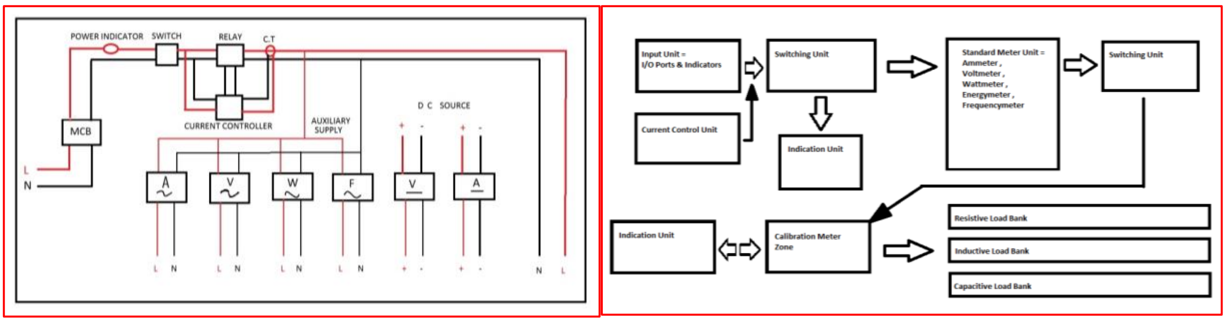

Figure1: Circuit & Block diagram.

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IV. RESULTS AND DISCUSSION

Costing to build a unit

It depends on various parameters like meter ranges, meter price, other protection unit ranges, etc. If you increase the range of meters for calibration then costing also increases. We made a unit for following meter specifications. It costs near about Rs.13K. If u made such unit in bulk numbers then definitely the costing per unit reduces i.e. its near about Rs.9K. we can make handy unit for various types meters for calibration but we made it for limited features because of budget matters & we do not need more features for calibration.

Calibration charges of other companies in market compare to our service

Calibration charges are Rs.200 to Rs.500 per unit for voltmeters, ammeters, watt meters, frequency meters, energy meters depending on ranges.

Authority permissions

For giving service of calibration to customers or we can say clients, we have to take some rights from standard authorities, if rights are not there, then how you give service? So our module is authorized with license from standard calibration laboratory as per NABL standards. Licensed & certified our module on 15 April 2021 by Smart calibration lab, Pune.

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SERVICES FOR SCIENCE

SMART CALIBRATION LABORATORY
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CALIBRATION OF METER TESTING AND CALIBRATION EQUIPMENT

PARTY NAME- AISHWARYA ASWALE , KOLHAPUR
SR NO-3465462H34/2021 ADDRESS - KOLHAPUR
CALIBRATION DATE- 15/04/2021 NEXT CALIBRATION DATE -15/04/2022
CERTIFICATE NO-366

SR NO	AMMETER		VOLTMETER	WATTMETER	FREQUENCY METER
01	01	0.99	100-100	50-50	48-48
02	02	1.99	150-150	60-60	50-50
03	03	3.99	200-200	80-80	52-52
ACCURACY	99%		100%	100%	100%
LOAD	90%		95%	98%	99%
RESULT	OK		OK	OK	OK

LAB TECHNICIAN LAB IN CHARGE DEPARTMENT HEAD

CALIBRATION CONNECT

Figure2: Calibration test report of our handy unit

Table 1. Meters which are calibrated on unit

Wattmeter	1250 W 5 A AC
Ammeter	10 A AC
Voltmeter	600 V AC
Ammeter	30 A DC
Voltmeter	20 V DC
Frequency meter	55 Hz
Microcontroller Based Energy Meter Calibration Unit	1 nos.

Table 2. Loads connected on unit

Resistive Load	300 – 600 W (600W actually connected)
Inductive Load	10 mH – 100 H (11.5W actually connected)
Capacitive Load	5 mfd – 30 mfd (275W actually connected)

	We can give max. load of 1.5 kw

Example of calibration test report of Voltmeter (AC)

Calibration Certificate of : **Voltmeter (AC)**
Certificate No 18-SEBC06/01/042 Date of Calibration: 06/02/2018 Page No.1/1
Calibrated for

Work order No.	: 18-SEB06/01 Dated:- 06/02/2018	Condition of Item Receipt: Ok	
ID Code	BPGCL/K8-30/VM	Finiks Id.No.	18-SEB06/01/042
Make	Selec	Model	--
Range	0-400 V AC	Least Count	0.1 V AC
Location	K8-30	Cell	BPGCL

Environmental Condition : Temperature :Temperature : 25°C ± 4°C Humidity: 50 % RH ± 15%RH
Calibration Procedure: CP/75/02 CP/76/02 **Location of Calibration** : On Site
Reference Document Used: IS 1248-2003
Equipment / Reference Standard Used For Calibration : Traceable to National Standard.

Equipment	Identification No.	Certificate No.	Calib. Date	Valid up to
5 &1/2 MFC	Finiks/MFC-01	NCQC-E/140917/01	14/09/2017	13/09/2018

Parameter : Voltage

CALIBRATION RESULTS

Calibration Point	STD Reading	UUC Reading	Error
V	V	V	V
50	50.0	50.2	0.20
100	100.0	100.2	0.20
150	150.0	150.3	0.30
200	200.0	200.4	0.40
250	250.0	250.5	0.50
300	300.0	300.7	0.70
350	350.0	350.8	0.80
400	400.0	400.9	0.90

Uncertainty of Measurement : ± 0.05 %
The reported uncertainty is at coverage factor K=2 which corresponds to a coverage probability of approximately 95% for normal distribution.

Next Date of Calibration (suggested by Customer): 05/02/2019

Figure3: Calibration test report of Voltmeter

Photos of module

V. CONCLUSION

We are learning & learned related to what to do to establish a calibration laboratory or giving services like laboratories, calibration companies, etc. Now we can give a service on site now in affordable price for some types of electrical meters. That's it. Now we work only for limited meters or instruments. But in future we can give all calibration related services. I think, we also interested to put efforts in manufacturing industry of such calibration & meters. Smart meters are becoming increasingly popular. In order to facilitate some processes or solve some problems, researchers add more options and functionalities to these types of instruments. In our scenario, we're attempting to integrate the calibration process and run it from a remote location. This paper outlines informative requirements and good guidance for various stakeholders and service providers in the metering industry who are responsible for maintaining metrological and functional performance throughout the long unattended period of useful life of ac electricity meters, including testing, evaluation, installation, and maintenance. The goal is to develop a performance-based good meter asset management strategy.

VI. REFERENCES

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