भारतीय मानक

Indian Standard

a.c. Static Transformer Operated Watthour and Var-Hour Smart Meters, Class 0.2S, 0.5S and 1.0S

Part 2 Specification Transformer Operated Smart Meters

ICS 91.140.50

Equipment for Electrical Energy Measurement, Tariff and Load Control Sectional Committee, ETD 13

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Equipment for Electrical Energy Measurement, Tariff and Load Control Sectional Committee had been approved by the Electrotechnical Division Council.

Several programs have been launched by Government of India to reform the energy and power sector. One such initiative was introduction of IT enabled services that have set the platform for deploying Smart Grids in India. The Smart Grid *via* its environment friendly and consumer centric approach would offer enhanced reliability, security, safety and efficiency for grid operations. The transition to Smart Grid would achieve the over arching objectives of Government to reduce AT&C losses and provide 24×7 power for all.

Advanced Metering Infrastructure (AMI) is a crucial part of a Smart Grid. It is an integrated system of smart meters, communication networks and data management systems that enables two way communications between the utilities and consumer premises equipment. The functional blocks of AMI typically include HES — Head end system, WAN — Wide area network, NAN — Neighborhood area network, Data concentrator unit (DCU)/ Gateway and HAN — Home area network.

Smart meter is a composite unit consisting of metrology elements, two way communication module/modules and control elements. It will have functions such as measurement, computation, event capturing, storing, communication and control. The smart meter would be required to provide data and information that are needed by various Smart Grid applications.

Smart grid deployment process is still evolving. Various domains of Smart Grids are infused with professional interventions to adopt and rollout standards-based technologies and products. Many standard making bodies like IEC, IEEE, NIST, CEN, CENELEC, ITU, ETSI, and IETF are engaged in standardization activities pertaining to Smart Grids.

The Electrotechnical department of Bureau of Indian Standards has formulated many metering standards such as IS 13779 : 1999 'a.c. Static watthour meters (Class 1 and 2) (*first revision*)', IS 14697 : 1999 'a.c. Static transformer operated watthour and var-hour meters, class 0.2S and 0.5S — Specification', IS 15884 : 2010 'Alternating current direct connected static pre-payment meters for active energy (Class 1 and 2) — Specification', IS 15959 (Part 1) : 2011 'Electricity metering — Data exchange for meter reading, tariff and load control — Companion specification Part 1 Static Energy Meter' and IS 16444 : 2015 'a.c. Static Direct Connected Watthour Smart Meter Class 1 and 2 — Specification'. This standard on the smart meter has been formulated by Bureau of Indian Standards based on the technical specifications and functional requirements published in June 2013 by Central Electricity Authority.

The letter 'S' denotes special measuring range designated for transformer operated applications, generally for large power measurements. Current transformers also 'S' designated as per IS 2705 (Part 2) : 1992 'Current transformers: Part 2 Measuring current transformers (*second revision*)' have measuring ranges comparable to those of static meters covered by this standard. For the sake of overall accuracy throughout the measuring range, static meters covered by this standard should preferably be connected with 'S' designated current transformers. For example class 0.5 S meters is used with 0.2 S CT and class 0.2 S meter is used with 0.2 S CT.

While formulating this standard it has been endeavored not to contradict on principle of the adopted/referred standards of other International organizations/institutions on which this standard is based upon. However, in case of any divergence/disparity, not amounting to conflict of interpretations that may be revealed later, provisions of this standard will prevail.

This standard specifies the requirements for smart meters only. Requirements for any other components shown or referred in the text or diagrams such as DCU, HES, IHD, HHU may be specified separately for functional and

Indian Standard

a.c. STATIC TRANSFORMER OPERATED WATTHOUR AND VAR-HOUR SMART METERS, CLASS 0.2S, 0.5S AND 1.0S

PART 2 SPECIFICATION TRANSFORMER OPERATED SMART METERS

1 SCOPE

1.1 This standard (Part 2) specifies ac static transformer operated watthour and var-hour smart meters of accuracy class 0.2S,0.5S and 1.0S for the measurement of alternating current electrical active and reactive energy of frequency in the range 50 Hz for single phase and three phase balanced and unbalanced loads. It applies to their type tests, routine tests and acceptance tests.

1.2 It applies only to transformer operated static watthour and var-hour meters consisting of measuring element(s) and register(s) enclosed together in the meter case. It also applies to operation indicator(s) and test output(s). It also applies to multirate tariff meters and meters which measure energy in both directions.

1.3 Some versions of static reactive energy (var-hour) meters may deemed to be covered by this standard as if these are active energy (watthour) meters of appropriate accuracy class with necessary adjustment to power factor. Although it is possible to achieve Class 0.2 S accuracy in static var-hour meters, it is of general opinion that accuracy attainable for var-hour measurement is one level inferior to that in the case of kWh measurement with identical design of measuring elements. Therefore, it is possible for this standard to cover static var-hour meter, Class 0.2 S, and 0.5 S for reactive energy measurement in all transformer operated applications. Only 'power factor' wherever it has appeared in this standard, shall be read as 'sin Ø inductive' or 'sin Ø capacitive'. Where Ø is respectively the lagging or the leading power factor angle

1.4 It applies to,

a) transformer operated static watt-hour meters consisting of measuring element(s), time of use of register(s), display and built in type bi-directional communication module all integral with the meter housing.

b) Alternately, the bi-directional communication module could be plug-in type on a dedicated slot with suitable sealing arrangement. The plug-in module shall be field swappable with suitable integrated communication module as agreed between the buyer and the seller.

1.5 The smart meter types as specified in **1.4** (a) and **1.4** (b) shall be suitable for indoor usage and capable of 'forwarded only' or 'import and export' energy measurement.

1.6 It does not apply to,

a) watthour meters and var-hours meters where the voltage across the connection terminal exceeds 600 V (line to line voltage for meters for poly phase systems), and

b) portable meters, and outdoor meters.

1.7 For rack-mounted meters, the mechanical requirements are not covered in this standard.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No./ International Standard	*Title*
14697: 1999	a.c. Static transformer operated watt-hour and var-hour meters, Class 0.2S, 0.5S and 1.0S — Specification
15959 (Part 1): 2011	Data exchange for electricity meter reading, tariff and load control — Companion : specification Static energy meter
(Part 2): 2016	Smart meter
IEEE 802.15.4: 2003	Standard for local and metropolitan area networks
IEEE 1901: 2010	Standard for broadband over power line networks: Medium access control and physical layer specifications
IEEE 1901.2: 2013	Standard for low-frequency narrow band power line communications for smart grid applications
ITU-T G.9901: 2014	Narrowband orthogonal frequency division multiplexing power line communication transceivers — Power spectral density specification

IS No./ International Standard	*Title*
ITU-T G.9903 : 2014	Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks
ITU-T G.9904: 2012	Narrowband orthogonal frequency division multiplexing power line communication transceivers for prime networks

3 TERMINOLOGY

3.1 General Definitions — For the purpose of this standard all definitions given in IS 14697, IS 15959 (Parts 1, 2 and 3) and the following shall apply.

3.2 Definitions of General Smart Metering Terms

3.2.1 *Smart Meter* — Smart meter is an a.c. static transformer operated watthour and Var-hour meter with time of use registers and two way communication capabilities.

It is designed to measure 'forwarded only' or 'import and export' energy, store and communicate the same along with other parameters defined in this standard. It shall be remotely accessed for collecting data/events, programming for selected parameters.

Load switch is not applicable for the meters covered in this standard.

3.2.2 *Neighborhood Area Network [NAN]* — This is a network comprising of group of smart meters and any other network elements such as DCU all of which communicate in a two way mode.

3.2.3 *Data Concentrator Unit [DCU]* — This device is part of NAN. It acts as a secured aggregate router and is an interface between smart meter and HES. It shall facilitate secured two way data transfer either in transparent/store and forward mode as per system designs. The other terminologies like Network Element/ Grid Router/Access point/edge router shall be synonymously used in place of DCU. This standard does not cover the requirements of DCU.

3.2.4 *Head End System [HES]* — This entity is a set of ICT based systems situated at the top of AMI system and receives data and events over NAN/WAN. HES is responsible for using these data/information and manage NAN/WAN components, smart meters and IHD. HES is also responsible for handling security keys, passwords intended for smart meter programmability and firmware upgrade and host applications such as remote connect/disconnect, analytics, billing, messaging etc. This standard does not cover the requirements of HES.

3.2.5 *In Home Display [IHD]* — This is a compact display module meant for mounting inside the consumer premises. The IHD shall receive data/ messages from smart meter and send responses to smart meter as and when required from HES. This standard does not cover the requirements of IHD.

3.2.6 *Hand Held Unit [HHU]* — This is a device used to communicating locally over the optical port to the smart meter. Communication functionality requirements are as mentioned in IS 15959 (Part 2).

3.2.7 *Forwarded Energy*

It is the measurement of energy in import register for energy in both forward and reverse direction.

3.2.8 *Import Energy*

It is the measurement of energy in import register for energy in forward direction only

3.2.9 *Export Energy*

It is the measurement of energy in export register for energy in reverse direction only.

4 GLOSSARY OF TERMS

AMI	:	Advanced metering infrastructure
AT&C	:	Aggregate technical and commercial
CEA	:	Central electricity authority
COSEM	:	Companion specification for energy metering
DCU	:	Data concentrator unit
DLMS	:	Device language message specification
DoT	:	Department of telecom
DSM	:	Demand side management
DR	:	Demand response
ETA	:	Equipment type approval
ETSI	:	European telecommunications standards institute
HAN	:	Home area network
HHU	:	Hand held unit
ICT	:	Information and communications technology
IEC	:	International electro technical commission
IEEE	:	Institute of electrical and electronics engineers
IETF	:	Internet engineering task force
IHD	:	In home display
IS	:	Indian standard
ITU	:	International telecommunication union
LCD	:	Liquid crystal display
NAN	:	Neighborhood area network
PLC	:	Power line communication
RF	:	Radio frequency