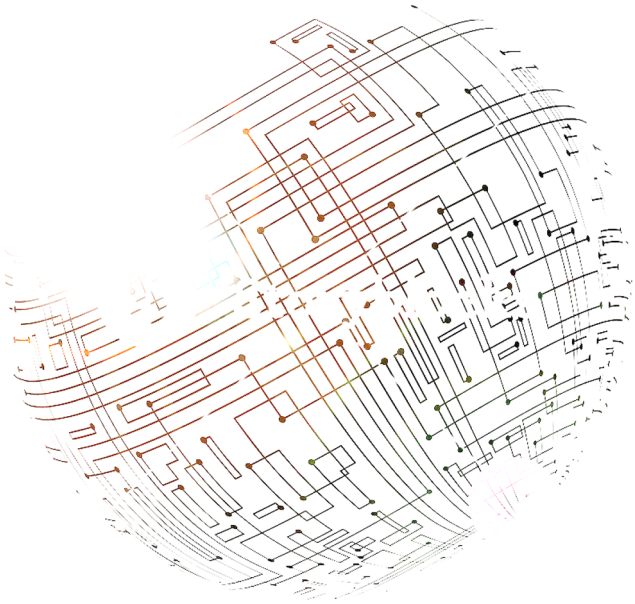

Verticross India Pvt. Ltd.

SMART METER – Detail Specification

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CODES AND STANDARDS

The meter covered in this specification confirms to the Indian / IEC standards.

Standard	Description
IS- 16444	***AC Static Watthour Smart Meters, Direct Connected Class 1 and 2***
IS- 13779	***Metrology class 1.0***
IS- 15959	***Data exchange, Tariff and load control***
IEC - 61000	***EMI / EMC***
IS – 9000	***Environmental***

SPECIFICATIONS

Parameter	Requirement
Meter Type	1-Phase, 2 wire Static Watt-hour Smart Meter, comprising of measuring elements, display, memory, load switch with bi-directional communication module all to be housed in meter.
Connection	Whole current
Reference and operating Voltage	Reference Voltage (V_{ref}) = 240 Volt Meter is operational with required accuracy from 60% of V_{ref} to 120% of V_{ref}. However, meter shall with stand with the maximum system voltage of 440 volts (for minimum 5 minutes).
Rated Current	Base Current - 5 /10 Amps Maximum current – 30 / 40 Amps
Starting Current	0.2% of base current (Phase or neutral)
Operating Frequency	50Hz ± 5%
Accuracy Class	Class 1.0 accuracy - shall comply accuracy requirements under IS 13779 or IEC 61036

Power Factor Range	0.5 Lag – unity - 0.8 Lead
Immunity to phaseand earth fault	Meter complies to IS 13779
Temperatur eRange	Operating Temperature: -10^{O}C to 60^{O}C Storage / Transport Temperature: -25^{O}C to 70^{O}C
Relative Humidity	0 to 96%
Initial start-up ofmeter	Meter is fully functional within 5 seconds after referencevoltage is applied to its terminals.
Display	LCD. Visibility is sufficient to read the meter mounted at aheight of 0.5m to 2.0m and temperature range -25^{O}C to 70^{O}C
Number of displaydigits	6 digits in 1 row
Data Retention	As per CEA regulations
Real Time Clock(RTC)	The meter has internal real time clock to set date and time. The Real Time Clock (RTC) has long life (7 Years), it is with permanent Non-Rechargeable Battery. RTC has separatebattery backup. Meter has the capability of Time synchronization with proper authentication.
Meter Body	➢ Base body and top cover is made of UV stabilized, unbreakable high-grade flame retardant insulating material ofgood dielectric and mechanical strength ➢ Base body is opaque ➢ Top cover is transparent or opaque/translucent with viewing window. ➢ Meter is sealed in such a way that opening of meter base and cover is not possible without breaking the seals ➢ Thickness of meter body (Base and Terminal cover) is 2mm minimum ➢ Only unidirectional screws to be used on meter cover wherever required.

Terminal Block	➢ The terminal block is moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength ➢ The moulded terminal block is made from best quality phenol formaldehyde/Poly carbonate conforming to IS:13779-1999 (latest amended) having adequate insulating properties and mechanical strength with brass inserts for connecting terminals ➢ Terminal block is opaque ➢ Terminal block is capable of passing the tests as per ISO-75 for a temperature of 135^{O}C and pressure of 1.8MPa ➢ The terminals is designed to ensure adequate and durable contact such that there is no risk of loosening or undue heating ➢ Terminal block is such that the risk of corrosion due tocontact with other metal part is minimized ➢ Electrical connections is designed such that contact pressure is not transmitted through insulating material.
Terminal cover	➢ Provision of sealing at one point through sealing screw ➢ The sealing screws is held captive in the terminal cover. ➢ The terminal cover is extended type (30 mm) with bafflewall above the cable entry base wall so that access to the terminals is not possible (even with thin metallic wire) withoutbreaking the seal. ➢ Terminal cover has the provision for cable entry from bottom. ➢ Terminal cover has sufficient space for incoming and outgoing cable such that these can pass without stressing anddamaging the terminal cover. ➢ Diagram of external connections is embossed on clearlyon inside portion of terminal cover. Meter terminals shall also be marked, and this marking shall appear in the above diagram
Terminals	➢ Terminals is suitable for 25 Sq. mm aluminum cable. ➢ Two no's flat head screws and washers per terminal is provided ➢ Material of terminals, screws and washers is brass or tinned copper. Terminals is tested for continuous currentof 150 % I_{max}. ➢ Terminals is clearly marked for phase / neutral / outgoingetc. this marking shall appear in the connection diagram. ➢ Clearances and creepage is as per IS 13779. ➢ The terminals and connections is suitable to carry up to 120% of Imax continuously ➢ The manner of fixing the conductors to the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating.

Screws	All electrically live screws is of brass/ nickel tin-plated. Allother screws is electro plated.
Output device	➢ Meter has flashing LED visible from the front to represent energy recording. Resolution is such that satisfactory accuracy test can be conducted at the lowest load in less than 5 minutes and starting current test in less than 10 minutes. ➢ Meter has provision on LCD for indicating data communication in progress. ➢ Meter has indicator on LCD for displaying the status ofload switch.
Memory	➢ Non-volatile memory independent of battery backup, memory is retained up to 10 year without any auxiliary power
Load Control Switch	➢ Smart meter is equipped with integrated load control switches to control flow of electricity to the load at the instanceof connect/ disconnect commands as per functional need of thesystem ➢ Load switch is incompliance to IS 15884 and IS 16444 or equivalent IEC specifications ➢ Load switch for connect/ disconnect purpose is mounted inside the meter with suitable arrangement
Communicatio n module of meterfor AMI	➢ Smart meter has provision of 1 no. of RF / GPRS communication module. This module is compatible with low-power wide-area network (LPWAN) for two-way communication
Meter Sealing Arrangemen t	➢ Reliable sealing arrangement is provided to make the meter tamper evident and to avoid fiddling or tampering byunauthorized persons ➢ Sealing is in accordance with IS and CEA metering regulations with latest amendments ➢ In case of plug in communication module, sealing arrangementshall also be provided for the same
Manufacturer's / P&ED Seals	➢ Manufacturer provides one polycarbonate seal on either side/front of the meter ➢ Two hologram sticker seals on both sides of meter with logo ofP&ED/manufacturer and the polycarbonate and sticker seals having the same number as that of the meter Sr. No. ➢ One no. polycarbonate seal in loose condition is provided for terminal cover of the meter. ➢ The Serial Number of Meter, Polycarbonate Body Seal/ StickerSeal and Loose Seal for Terminal Cover is same
Seal record	➢ Record of all seals is forwarded to purchaser with each lot.The manufacturer provides the software in adequate numbers as per P&ED's requirement for tracking and recording of seals.

Name Plate andmarking	➢ Meter has the clearly visible, indelible and distinctly marked name plate in accordance with IS 16444.
Connection Diagram	➢ The connection diagram of the meter is clearly shown on the meter nameplate and is of permanent nature. Alternatively, connection diagram can be permanently embossed on the inside/outside portion of terminal cover.
Protection	➢ IP 51
Communication	➢ Optical port ➢ 4G / RF ➢ AES 128 encryption

FUNCTIONAL REQUIREMENT

Parameter	Requirement
Meter category	Smart meter complies D1 category of IS 15959
Security	Advanced security as per IS 15959 is provided
Encryption for data communication	As per IS 15959
Self- Registration	a. Last mile network supports auto-registration and self-healingfeature to continue operation using easiest possible available route in case of failure of any communication device in the network b. Meter once powered-up the NIC card is self-detected by communication network and its basic name plate details & current readings is transferred to HES

Instantaneous Parameters	1. Following parameters is continuously updated by the meter hardware/software as per internal sampling and computation timeand last updated value is available for downloading as and when required. 2. Real time clock date and time 3. Voltage 4. Phase Current 5. Neutral Current 6. Signed power factor 7. Frequency, Hz 8. Cumulative energy 9. Maximum Demand 10. Cumulative power ON duration in min 11. Cumulative tamper count 12. Cumulative billing count 13. Cumulative programming count 14. Load Switch Function Status
Load survey Data	➢ Following parameters is measured and recorded at the end ofeach 15 min interval for last 60 days. 1. Real time clock date and time 2. Voltage 3. Voltage- average values during the block period time. 4. Energies are consumption during the block period. 5. All parameters are stored at the end of capture period. 6. The time stamp is at the end of capture period.
Daily load profile	➢ Following parameters is measured and recorded at each midnight i.e. 00:00 hrs for last 60 days. 1. Real Time clock- date and time 2. Cumulative energy
Name Plate Detail	1. Meter SLNo. 2. Device ID 3. Manufacture's name 4. Firmware version for meter 5. Meter type-(1P-2W) 6. Category-(D1) 7. Current Rating - Amps 8. Meter Year of manufacture-YYYY

Programmabl eparameters	a. Following parameters can be programmed and Every transactionis logged in non-volatile memory of the meter with date and time stamp. i. Real time clock, date and time ii. Load Limit(kW) iii. Enable/Disable load limit function b. On change of time zone settings, the on-going billing cycle data will be generated, and a new billing cycle is commenced asper new activity calendar c. Programming of any of the parameters shall increment the'Cumulative programmable count' value
Push Services	As per IS 15959 Smart meter will automatically notify data, event, and messagesto a destination client system in an unsolicited manner (without a request from a client) as per IS 15959
Periodic push	a. Meter is able to push following instantaneous parameters to HES at pre-defined intervals. i. Device ID ii. Real Time clock- Date and time iii. Voltage iv. Phase current v. Signed Power factor vi. Apparent power KVA vii. Active power Kw viii. Cumulative Energy
Event Push	a Meter is able to report HES, the status change of any of theidentified events like, • Earth Loading • Influence of permanent magnet or AC/DC electromagnet • Neutral disturbance- HF, DC or AC • Meter cover opening • Meter load Disconnected/ meter load connected • Power Outage • Power Restoration • Manual/ MRI reset
Firmwar e upgrade	a. As per IS 15959 b. Smart meter shall support remote firmware upgrade feature. c. Firmware upgrade is limited to the communication firmware only.

Disconnectio nmechanism	a. The Smart meter shall support disconnection (all the switches shall operate) on the following conditions as per IS16444 i. Over current (105 % of I_{max} in any phase for predefinedpersistence time.) ii. Load control limit (Programmable) iii. Pre-programmed tamper conditions (Factory programmed) iv. Disconnection signal from Head end system v. Pre-paid meter disconnection functionality for pre-paymentmode b. Load Control limits is programmable locally and remotely c. Relay for connect/disconnect shall comply all relevant requirements of IS15884
Local reconnectio n	1. The meter will try to reconnect the load up to predefined time,with predefined interval (Time and interval is programmable) 2. If the consumption is still more than the programmed limits, itwill logout and wait for 30minutes 3. If the consumption is still above the limit, the procedure defined above in 1 and 2 shall be repeated
Reconnectio n mechanism	1. Reconnection is done from HES except for over current andload control limit. 2. Reconnection in case of prepayment meter is as per prepayment profile and balance/credit availability in the meter.
Outage Management	1. The meter will send abnormalities at the OMS end like Power failure (Last Gasp), Power Restoration (First Breath) to HES
Status of load switch	2. Indication of status of relay i.e. connected/ disconnected is available on display as well as through communication to HES. 3. Connection and disconnection is logged as events.
On demand readings	1. On request from HES

ANTI-TAMPER AND FRAUD DETECTION REQUIREMENT

Current Related	a. Occurrence and restoration of following current related eventswill be logged in meter memory as per IS 15959 b. For each occurrence event captured, the cumulative tamper count will be incremented c. Selective access is provided as per IS 15959
Earth Tamper	a. Whenever a Meter should log earth tamper. Continuous indication through LED flag or icon on display is provided for this tamper
Power related	a. Occurrence and restoration of following Power related events is logged in meter memory as per is15959. b. Only Real clock (date and time) and event code will be captured. c. Selective access is provided as per of IS 15959.
Power On/ Off	Meter will detect occurrence and restoration of power off. if the phase voltage is absent more than a threshold period of time
Voltage related	a. Occurrence and restoration of following Voltage related eventsis logged in meter memory b. For each occurrence event captured, the cumulative tamper count is incremented
Low VoltageLogging	Event is logged in memory along with Occurrence and restoration event data. Threshold is below 180 Volts.
Others	a. Occurrence and restoration of following events is loggedin meter memory as per IS 15959 b. For each occurrence event captured ,the cumulative tamper count will be incremented c. Selective access is provided as per IS15959
Singlewire power	Meter should log this tamper when incoming and outgoing neutral/ phase are disconnected and load connected to earth.Meter should record energy as per load, Vref and UPF. Meter display should not go blank during this tamper.
Connection Related Tamper Conditions	The meter shall not get affected by any remote-control device & will continue recording energy
I/C & O/G Interchanged	Meter should record forward energy within limits of accuracy class 1.0.
Phase & Neutral Interchanged	Meter should record forward energy within limits of accuracy class1.0.

I/C (Phase & Neutral) Interchanged,	Meter should record forward energy within limits of accuracy class1.0
I/C Neutral Disconnected, O/G Neutral & Load Connected To Earth.	Meter should record forward energy
I/C Neutral Disconnected, O/G Neutral Connected to Earth Through Resistor& Load Connected To Earth.	Meter should record forward energy
I/C Neutral connected,O/G Neutral Connected ToEarth Through Resistor& Load Connected To Earth.	Meter should record forward energy
Event Logging	Total number of events to be stored is minimum 20 for power On/OFF event and not more than 50 for all other events in FIFO basis.
Parameter Snapshot	Captured parameters mentioned above are to be captured when event occurrence and restoration is logged as per IS 15959. i. Date and time of event ii. Event code iii. Current - instantaneous current of the element (Phase orNeutral) used for energy consumption. iv. Voltage v. Power factor vi. Cumulative energy-kWh
Tamper Indication	Appropriate Indications/Icons for all tampers should appear on themeter display either continuously or in auto display mode.
Tamper Logics	A logic sheet for tamper/ event detection and logging is submitted for purchaser's approval. Following details is provided for each tamper in tabular form a. Detailed Tamper logic b. Threshold values c. Persistence times d. Restoration time e. Event count

METER DISPLAY

The measured value(s) is displayed on a Liquid Crystal display (LCD) register. The display has the backlit capability for easy reading. When the LCD is placed at a constant temperature of 65^{O}C for a period of 30 minutes in operating condition and 80^{O}C for 30 minutes under de-energized / storage condition, it should not get deformed.

<table>
<tr><th>Parameter</th><th>Requirement</th></tr>
<tr><td>LCD Type</td><td>Backlit LCD</td></tr>
<tr><td>Viewing angle</td><td>

Display has viewing angle 35 degree up &down from eye level.
The display visibility is sufficient to read the Meter mounted at height of 0.5 m as well as at the height of 2m.

</td></tr>
<tr><td>Size of LCD</td><td>

Minimum 10X5mm

</td></tr>
<tr><td>LCD Digits</td><td>

Total 6 digits in one row

</td></tr>
<tr><td>LCD language</td><td>

English

</td></tr>
<tr><td>Display mode</td><td>

Following parameters is displayed in Auto scroll with programmable interval

<table>
<tr><td>Order</td><td>Parameter</td><td>Display Time</td></tr>
<tr><td>1</td><td>LCD Test</td><td>5 sec</td></tr>
<tr><td>2</td><td>Meter Sr no.</td><td>5 sec</td></tr>
<tr><td>3</td><td>Date</td><td>5 sec</td></tr>
<tr><td>4</td><td>Time</td><td>5 sec</td></tr>
<tr><td>5</td><td>Cumulative kWh</td><td>30 sec</td></tr>
<tr><td>6</td><td>Current Month MD</td><td>5 sec</td></tr>
<tr><td>7</td><td>Instantaneous Voltage</td><td>5 sec</td></tr>
<tr><td>8</td><td>Instantaneous Current</td><td>5 sec</td></tr>
<tr><td>9</td><td>Instantaneous Load KW</td><td>10 sec</td></tr>
</table>

Permanent Display on LCD
Supply indication
Relay Status
Earth Load Indication (If conditioned occurred)

</td></tr>
<tr><td>Display indications</td><td>

Appropriate indications/flags for all tampers and self-diagnosticfeatures is provided
Data Communication
Relay Status

</td></tr>
</table>

SOFTWARE AND COMMUNICATION

Communication Ports	The meter has the 1 RF / GPRS communication module
RF NIC Module	Meter shall has provision for RF NIC Module as per the Communication topology requirement to ensure data availabilitywith LPWAN network
Integration	Meter data is integrated with HES.
Software for local communication	Software is provided for downloading data from meter memory.
Port protection	All ports are optically isolated from the power circuit
Communication protocol	As per IS 15959
Data transfer rate	Communication ports supports data transfer rate of 9600 bps(minimum)

NAME PLATE

Meter has a nameplate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards.
The manufacturer's meterconstant is marked on the nameplate. In addition to the requirement as per IS, following are marked on the Nameplate

• Meter Serial number. Serial number is printed in black colour. Embossing is not acceptable.
• Size of the digit is minimum 5X3mm
• Bar code is printed along with serial number; The Size of Bar Code shall not be less than 35 x 5 mm. Stickers in any case will Not be accepted.
• BIS registration mark (ISI mark)
• 'P&ED' insignia
• Purchase order Number & Date
• Manufacturers name and country of origin
• Model type / number of meter
• Month & Year of manufacturing
• Reference voltage / current rating
• The number of phases and the number of wires for which the meter is suitable. Graphical symbol as per IS 12032 can be used.
• Meter constant
• Class index of meter
• Reference frequency
• Warranty period
• Communication technology with carrier frequency Symbol of load switch