

Technical Specifications
GUYANA POWER & LIGHT INCORPORATED
TECHNICAL SPECIFICATION
FOR
SINGLE-PHASE SPLIT PREPAYMENT DIN RAIL MOUNTING
STATIC WATTHOUR METERS FOR ACTIVE ENERGY
(Using Power Line Carrier communication protocol between MCU and CIU)

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INTRODUCTION

This specification was prepared by the Metering Department of the Guyana Power & Light Inc. (GPL). It lays down requirements for single-phase DIN rail mounting split prepayment meters for active energy, where the communication between MCU and CIU is by means of Power Line Carrier. The specification is intended for procurement of equipment and does not include provision of contract.

This specification was prepared to establish and promote uniform requirements for single phase split prepayment meters for active energy to be used by Guyana Power and Light Inc. The specification lays down the minimum requirements for equipment acceptable for evaluation.

- **SCOPE**

This specification applies to newly manufactured, single-phase Din rail mounting static watt-hour prepayment meters for direct connection, for measurement of alternating current electrical energy consumption at a nominal frequency of 60 Hz. The method of credit transfer shall be through encrypted numeric tokens complying with the 20-digits STS 6 or STS 2.0 encryption algorithms. The meters shall include a load switch for the purpose of interruption or restoration of the electricity supply to the load in accordance with the current value of the available credit maintained in the prepayment meter. The measurement and Control Unit (MCU) shall be separated from the Customer Interface Unit (CIU) and method of communication between them shall be by Power Line Carrier (PLC) for a distance not less than one hundred and fifty (150) meters.

- **REFERENCES**

The following documents were referred to during the preparation of this specification. In case of conflict, the requirements of this specification take precedence.

1. IEC 62055-31:2022, Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 0.5, 1 and 2).
2. IEC 62052-11:2020, Electricity Metering Equipment (a.c.) – General Requirements, Tests and Test Conditions- PART 11: Metering equipment.
3. IEC 62053-21:2003, Electricity metering equipment (a.c.) – Particular Requirements – Part 21: Static meters for active energy (class 1.0).
4. IEC 62056-21, Communication protocol.
5. ESKOM SCSSCAAA9, Communication protocol

- **TERMS AND DEFINITIONS**

The definition given in [1], [2] and [3] shall apply.

MCU: Measurement and Control Unit

CIU: Customer Interface Unit

PLC: Power Line Carrier

- **REQUIREMENTS**

Prepayment meters shall comply with the requirements of [1] and [3] for meters for active energy. The prepayment meters shall be mounted as for normal service.

- **Operating conditions requirements**

- The meters shall be suitable for operation in tropical climate where temperatures may vary from -10 to +45 degrees Celsius.
- Average Annual Relative humidity reaching 90%.
- The meters shall be used for measurement of active energy for loads under tropical climate conditions.

- **Design and construction requirements**

- **General**

- The requirements given in [1] shall apply.
- The measurement and Control Unit (MCU) shall be of DIN rail mounting with locking clip, to fit to a 35mm Din rail.
- The MCU and CIU shall communicate by power line carrier (PLC) for a distance of not less than one hundred and fifty (150) meters.
- The MCU dimensions shall not exceed: Height = 140mm; Width = 65mm, Dept = 90mm; and meter base shall be on the width side where the Din rail mount shall be located.
- The MCU shall be sealed to prevent tampering with the internal assembly.
- The meters terminal holes and screws shall be made of brass or nickel-plated brass for high conductivity and corrosion resistance.
- Terminal holes shall be of sufficient size to accommodate cables sizes of 10 – 25 mm diameter.
- The meters protection class shall be class II (Double insulated).
- The meters shall have a non-volatile memory capable of data storage and with long-term data retention period for a period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.

- The meters shall have register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc. These values shall be available on the CIU display.
- The principal unit for the measured values shall be the kilowatt-hour (kWh).
- The meter shall have a means of reading the credit register for testing purposes.
- The meters shall detect significant reverse energy (SRE) when the line and load wires are swapped.
- The meters shall continue to operate correctly and decrement credit or trip during SRE detection.
- The meters shall have LED indicators for testing and indication of kWh consumption.
- The meters shall have an optical communication port for accessing information stored inside the meter through a hand held unit.
- The meters shall have a communication interface for a Virtual Token Carrier (VTC), for accessing information stored inside the meter through a hand held unit [4] [5].
- The MCU shall conform to the degree of protection IP 51 as given in the IEC 529.

4.2.2 Functionality

4.2.2.1 Measurement and Control Unit (MCU)

- The MCU shall have a load switch to automatically interrupt the load circuit on the expiry of credit balance. The load switch shall automatically restore the load circuit.
- The meter load switch shall comply with the requirements given in [1].
- The meters shall be able to indicate absence or presence of continuous power
- The meters shall have a programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.
- The MCU shall have a diagnostic LED to indicate the presence of communication between the MCU and the CIU.
- The MCU should be fitted with LCD to display corresponding prompts from CIU and status of meter.
- The MCU shall continue metering and decrement credit, regardless of the state of the CIU.
- The MCU shall be supplied together with a plastic card of material to that of a credit card indicating the meter number. The meter serial number shall be engraved on the card.

4.2.2.2 Customer Interface Unit (CIU)

- The CIU shall comply with 20-digit (STS) encryption algorithms. All correctly entered tokens shall be registered to eliminate fraud.
- The CIU keypad shall be user friendly with a LCD display for numeric credit display and language independent pictograms to identified operational features. The height of the display characters for the numeric values shall not be less than 4.5mm.
- The display shall have at least seven 7-numerical characters comprising of five integers and two decimals.
- The CIU shall conform to the degree of protection IP 51 as given in IEC 529.
- The CIU shall Communicate with MCU by power line carrier (PLC) for a distance not less than one hundred and fifty (150) meters.
- The CIU shall be an interchangeable unit and it shall be possible to view the paired MCU on the CIU.
- The CIU shall enable loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.
- The CIU shall, upon acceptance of a valid token, credit the exact amount contained one the token to the appropriate register in the meter and shall increment the register by this amount.
- The CIU shall transfer the credit in kWh.
- The CIU shall display the cumulative kilowatt-hour register.
- The CIU shall have a means to remove digits from a partially entered number sequence-backspace key.
- The CIU shall have the ability to recall the last five successful credit tokens entered.
- The CIU shall indicate the status of the incoming supply.
- The CIU shall indicate the credit status.
- The CIU shall indicate token acceptance or rejection.
- The CIU shall give low credit warning by means of a flag on CIU display and audio alarm.
- The CIU shall have the ability to communicate, when the MCU is in tamper mode.
- The CIU battery terminals should not be placed directly on the circuit board.
- The CIU shall be able to communicate with different the voltages of meters.

4.3 Electrical Requirements

- The meters shall be operated from the mains with reference values of 120V – 240V, 60Hz
- The meters shall be connectable for 2-wire and 3-wire systems, drawing of which shall be printed on the meter body.
- The meter shall have reference standard currents of $I_b = 5 \text{ A}$, $I_{max} \geq 100 \text{ A}$
- Power consumption: The requirement of [3] applies.
- Influence of short-time over-currents: The requirement of [3] applies.
- Influence of self-heating: The requirement of [3] applies.
- Over-voltage: The requirement of [3] applies.
- Insulation test: The requirement of [3] applies.
- EMC tests: The requirement of [3] applies.

4.4 Accuracy requirements

- Tests and test conditions given in [2] shall apply.
- The meter's accuracy shall be of class 1 for active energy.
- Limits of errors due to variation of the current: The requirement of [3] applies.
- Limits of error due to influence quantities: The requirement of [3] applies.
- Test of starting and no-load condition: The requirement of [3] applies.
- Meter constant: The requirement of [3] applies.
- Accuracy test conditions: The requirement of [3] applies.

4.5 Tamper and Fraud Protection Requirements

- The Meter MCU shall be sealed to prevent tampering with the internal assembly.
- The meters shall detect significant reverse energy (SRE) when the line and load wires are swapped.
- The meters shall continue to operate correctly and decrement credit or trip during SRE detection.
- The meter should be capable of recording power on/off events in the meter memory. All potential failure should record as power off event.
- **The meter shall be able to detect, log and disconnect, all occurrences of terminal cover open events, if the cover is opened after initial installation.**

4.6 Instructions and Marking

4.6.1 General

The requirements given in [1] shall apply. The information shall be in legible English, indelibly marked on the meter and of at least 4mm figure height.

4.6.2 Specific Marking Requirements

The following information shall be marked on each meter, which shall be indelible, distinct and readable:

- The standard transfer specification (STS) compliant serial number, in the preferred format known as a national meter number.
- The STS compliance logo.
- Manufacturer's name and/or trade mark, place of and year of manufacturer;
- The no. of phases and no. of wires for which the meter is suitable for;
- Reference voltage;
- The basic current (I_b) and the maximum current (I_{max});
- The principal unit in which the meter reads;
- Meter constant;
- Class index of the meter;
- Reference Frequency;
- The inscription "Property of GPL Inc."
- Bar Coded information.

4.6.3 The following drawings and information shall be required with the tender:

- Meter drawing giving all the relevant dimensions;
- Wiring diagrams;
- Description leaflet of the meter being offered;
- Users and operational manuals.

4.6.4

A sample of the meter offered shall be submitted together with test tokens for; different Power Limit Settings and resets for the same, Credit and Clear Credit Tokens to aid in the testing of the meters. The manufacturer might be required to provide more tokens at no extra cost.

4.6.5

Copies of type approval certificate (s) with test and calibration results of the meter being offered obtained from an international or the national meter certification body shall be provided. If the type approval certificate (s) is (are) from accredited meter certification laboratories (and not national or international body), then it (they) shall be accompanied with copies of certificates of accreditation, under ISO/IEC 17025 from the national or an international certification body.

4.6.6

The manufacturer shall provide proof of conformance to ISO 9001 (2000) standards by attaching valid copy certificates.

- **INFORMATION AND WARRANTY (In case of Tender award)**
 - The meter shall have warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of eighteen (18) months from the date of delivery.
 - The supplier shall within (60) days, repair or replace all defective meters, free of cost at the ultimate destination.
 - In the event of any correction of defects or replacement of defective meters during the warranty period, the warranty for the corrected/replaced meters will be extended to a further period of twelve (12) months.

5.2 Samples

The tenderer shall submit a minimum of one sample for each type of meter together with the tender documents. Sample meters shall not be returned to the tenderers.

5.3 The meter shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

5.4 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers.

5.5 Where test and/or calibration certificates/reports are issued by a laboratory other than the International/National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/National meter certification body shall be attached together with the tender documents.

5.6 the manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national/international testing/calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.

6. SUMMARY OF TECHNICAL DATA

A. MEASUREMENT AND CONTROL UNIT (MCU)	
Type	Single phase, 2-wire and 3-wire direct connected prepayment meter
Compatible networks	Single phase, 2-wire and 3-wire, earthed neutral
Electrical ratings	
Accuracy	Class 1 (IEC 62053-21)
Voltage measurement	120V, 240V; 60Hz
Current measurement	I _b =5 A; I _{max} = 100 A
Protective class	Class II (double insulated)
MCU Enclosures	
Mounting	Rail mounting, with locking clip compatible with 35mm DIN
Rating	IP51, suitable for installation on pole-top or outdoor environment
Terminals	
Type	Moving-cage terminal
Material	Mild steel/nickel/brass
Maximum Cable Size	25 mm ²
Operating environment	
Area of application	Outdoor, enclosed meter
Operating temperature	0° C to 45° C
Relative humidity	Maximum 90%
Operation	
General	Credit store with decrement-on-use
Credit entry mechanism	Keypad; encrypted numeric tokens
Credit encryption	20-digits STS 6 or Version 2.0
Metrological performance	
Measurement	Forward and reverse detection and metering
Consumption	Visible LED
Status indication	Visible LED
Liquid Crystal Display	8 digits + icons; icon information, numeric information
Accurate metering	5% I _b to 120% I _{max}
Starting current	0.004 I _b
Short circuit current	30 I _{max}
Disconnection Device	
Type	Single pole latching contractor, 100 A
Insulation; Over voltage and Surge Protection	
Insulation System	Protective Class II
Over voltage withstand	300 VAC
Surge immunity Voltage impulse withstand	In excess of 6 kV, 1.2/50us (IEC 62052-11)
Communication Interface	
VTC Interface	9-pin Interface/Port (ESKOM SCSSCAA9)
Optical Interface	
Communication Circuitry	
Type	Low Voltage Power line carrier (IEC61334-4-41)
Communication Distance	150 meters
B. CUSTOMER INTERFACE UNIT	
Type	Isolated, non-polarized, 2 wire
Operating Range	At least 150 meters
Operating Environment	
Area of application	Indoor

Operating temperature	-10° C to 55° C
Relative humidity	75%
CIU Enclosure	
Mounting	Wall mounted
Rating	IP 51
Material	UV Stable polycarbonated / ABS blend with flame retardant
Sealing (Enclosure)	Factory sealed, no user serviceable parts
Type	Language - independent
Components	Pictographic/Numeric LCD display, keypad, LED rate of consumption indicator, audio feedback
Liquid Crystal Display (LCD) Size	At least 7 digits, icon information; numeric information display of various meter information such as credit levels, token entry, etc.
keypad	12-key, international standard layout including "information" and "backspace" keys
Light Emitting Diode (LED)	Rate of consumption indicator (pulse rate proportional to current rate of consumption)