RECHARGER Gem-Prepaid Electricity Meter
Technical Specification

Recharger Gem is a compact, single-phase, keypad‑based, prepayment electricity meter in British Standard (BS) housing. It is suitable for new reticulation as well as for retrofitting of existing electro-mechanical meters such as Ferraris meters.

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Overview

This specification sheet is for the Gem prepayment meter utilising **version 11.006 meter firmware.**

The meter is easy to install and boasts a large easy-to-read, language-independent display and a host of software features.

User interaction with the meter and access to meter information (such as a low credit warning, energy consumption, and load contactor status) are available using the keypad and large LCD display.

Features

- Compact meter design with British Standard layout
- Proven Cashpower keypad technology
- Programmable operating modes:
  - Prepayment
  - Credit metering
  - Energy Limiting Mode
- Tamper detection
- Significant Reverse Energy (SRE) detection
- Programmable software power limit
- Commissioning / decommissioning feature
- Clear, language-independent icons on the display
- Improved sealing against ingress of insects
- High surge withstand capability for areas prone to lightning or other line surges
- SABS 1524 and IEC 62055-31 compliant
- STS Compliant

Principle of Operation: Meter Modes

The Cashpower Gem meter provides utilities with the utmost flexibility in terms of being able to adapt to a range of different consumer profiles. Three, utility-programmable modes of operation are available and it is possible to switch between modes as required:

- Prepayment Mode
- Credit Mode
- Energy Limiting Mode

Prepayment Mode

In Prepayment metering mode, it functions as a normal prepayment meter. Credit tokens are purchased and entered into the meter via the customer interface unit keypad. On expiry of credit, the load is disconnected and will only be re-connected when a valid credit token, purchased by the consumer, is entered.

Credit Mode

In Credit metering mode, it functions as a conventional credit meter. Power is continuously supplied to the consumer and total kWh used is continuously measured and recorded. The meter must be read by the utility at regular intervals and the consumer billed accordingly.

Energy Limiting Mode

This mode allows utilities to distribute a fixed, monthly allocation of energy to consumers. It encourages the rational use of energy without severely inconveniencing the consumer. Operation is as follows:

Assume that a monthly energy allowance of 150kWh has been allocated to a consumer. The meter allocates this energy in regular, equal portions, over the thirty-day period i.e. by incrementing the kWh credit level with a value of 0.00087kWh every 15 seconds.

Assuming that the consumer draws no power at all, the credit level will continue to increase. However, as soon as energy starts to be used, the credit level is proportionately decremented. If the rate at which energy is being used is less than the rate at which it is being incremented, the credit level will slowly continue to increase. If the rate at which energy is being used is greater than the rate at which it is being incremented, the credit level will slowly decrease. It is in the consumer's interest to ensure that electricity is not wasted and that unnecessary appliances are turned off.

By conserving energy, it will be possible to use it at a high rate for periods when required.

In the event of the consumer exceeding the allocated allowance (credit level reduced to zero), the load is disconnected. However, the next allocation of credit will be available within a very short period of time (15 secs) and the supply of electricity restored.

Providing the consumer takes immediate steps to disconnect unnecessary appliances, it will be possible to have at least basic services available e.g. lighting. With a 150kWh monthly allocation of energy, it will be possible to maintain a continuous load of 200W whilst still maintaining a positive credit balance.
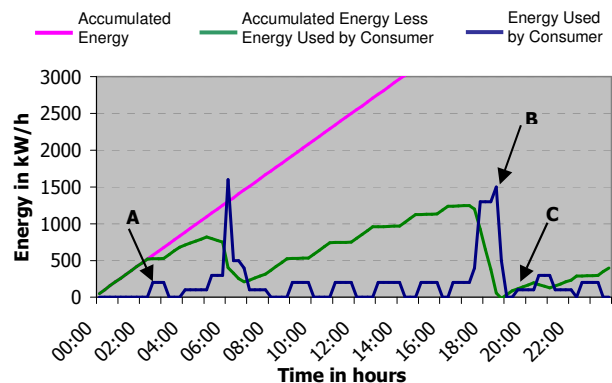

Figure 1: Graphical Representation of Typical Operation

A) Consumer starts using energy

B) Consumer depletes accumulated energy and load is disconnected

C) Consumer starts using energy again after load is re-connected

Tamper Detection

Cashpower Gem is mechanically sealed against tampering through the use of a factory-sealed screw plug on the rear panel and a utility-sealed wire seal on the front of the meter. The use of these mechanical seals ensures that there are visible signs of tampering if unauthorised entry to the system is attempted.

In addition, the meter is equipped with a tamper sensor that will automatically disconnect the power to the load in the event of tampering.

The meter includes a Significant Reverse Energy (SRE) detection feature. If the line and load wires are swapped during installation, the meter will continue to operate and decrement credit, however, the meter can be factory-programmed to tamper and disconnect the load should SRE be detected.

Optical Interface

An IEC 62056-21 compliant optical communications port is offered as a standard feature. This enables access to a variety of information stored inside the meter.

Surge Protection

The Gem family of meters has the option of being supplied with a built-in surge arrestor that is capable of sustaining up to 30kA during transients.

Interrogation Port

As a customer option, more detailed information and programming can be achieved via the standard interrogation port at the rear of the meter.

Technical specifications

General information

Meter Format
Single-phase, 2 wire, directly-connected keypad prepayment meter

Compatible Network(s)
Single-phase, 2 wire, earthed neutral[1]

Operation

General
Prepayment, Credit and Energy Limiting Modes

Credit Entry Mechanism
Keypad; encrypted numbers

Encryption Algorithms
STS Compliant[2]

Applicable Specifications
NRS009-1; NRS009-6-6; NRS009-6-7[3]

Electrical Ratings

Nominal Voltage – Rated voltage
230 Volts AC rms
(other voltages available on request)

Nominal Frequency
50Hz and 60Hz options available

Operating Voltage Range
80% to 120% of U_n (184V – 276V)

Maximum Continuous Current (I_{max})
80 Amps (Factory and field programmable to lower power limits)

Burden

Voltage circuit	<1.5W / <9VA @ 230V
Current circuit	<2.5 VA @ Base Reference Current (I_b)

Protective Class (according to IEC 62052-11)
Class ll (double insulated)

Metrological Performance

Measurement Direction
Forward and reverse power detection and metering[4] (credit is decremented in both directions)

Meter Constant (LED flash rate)
1000 impulses / kWh

Basic Reference Current (I_b)
10A

Accurate Metering Range
0.05 I_b to 1.2 I_{max} [5]

Starting Current
≤ 0.005 I_b (For Class 2)

Power Threshold
6.5W (approx. 28mA @ 230V and cos(Φ) = 1)[6]

Accuracy Class Index
Class 2 (Class 1 available on request)

Maximum Error – Class 2
< ± 2% over range 0.1 I_b to I_{max}; 0.5 ≤ cos(Φ) ≤ 1.0 (lead or lag)[7]

Disconnection Device

Type
Single pole latching contactor   100A

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[4] Will accurately meter energy if Line and Load connections are reversed. Can also be configured to tamper on reverse energy detection.
[5] The metering is accurate within the limits specified by IEC62053-21. Should a meter momentarily be operated outside its specified maximum current rating it will meter accurately up to 1.2 I_{max}.
[6] The Power Threshold represents the minimum load power that the meter will register. This value is programmable, with the recommended level for a base 10A meter shown.
[7] IEC 62053-21: 0.8 ≤ cos(Φ) ≤ 1.0 Leading, 0.5 ≤ cos(Φ) ≤ 1.0 Lagging

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[1] May be compatible with other network types as well – Consult Recharger
[2] STS = Standard Transfer Specification (Industry Standard)
[3] NRS = National Rationalised Specification (South Africa)

Insulation, Overvoltage and Surge Protection

Insulation System Classification
Protective Class ll (according to IEC 61036)

Insulation Level
4kV rms for 1 minute

Overvoltage Withstand
440VAC for 48 hours[8]
600VDC for 1 minute[9]

Surge Immunity – Voltage impulse withstand
Differential
In excess of 6kV, 1.2/50µs, with 2Ω source impedance (according to SABS 1524-1)

Surge Immunity – Current impulse withstand
Service rating:
5 kA 8/20µs (with optional surge arrestor populated)
Withstand rating:
30 kA, 4/10µs (with optional surge arrestor populated)

Surge Immunity - Specification compliance
SABS 1524-1, IEC 62052-11

Electromagnetic Compatibility (EMC)
Electrostatic discharge:
15 kV air discharge
Immunity to HF fields:
80 MHz to 2 GHz @ 10V/m with load, 80MHz to 2GHz @ 30V/m no load
Immunity to fast transient bursts:
4kV
Radio interference:
Complies with requirements for CISPR 22

Specification compliance:
IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22

Main Enclosure

Type
Layout according to BS5685 footprint Mounting

Mounting
Two mounting screws bottom (spacing according to BS5685). Top mounting bracket available as an option.

Rating
IP54 (IEC60529)

Material
UV Stable Polycarbonate/ABS blend with flame-retardant

Resistance to heat and fire
Complies with 960°C[10] glow-wire (IEC 60695-2-1)

Resistance to spread of fire
UL94-V0 rated @1.5mm. No toxic gases emitted: 'Green Material'[11]

Dimensions
168.5 mm(H) x 122 mm(W) x 68 mm(D) with long terminal cover [12]

Mass
570 g

Terminals

Layout
According to BS5685

Mains Terminals
Type   Double screw (M6), moving-cage terminal

Material   Mild steel, yellow passivated

Maximum cable size   25mm^2

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[8] This higher specification (440V as opposed to 400V) has not yet formed part of the official specification
[9] This higher end test is not a requirement of IEC 62052

[10] Only 650°C called for by standard industry specification
[11] No V-rating or 'Green' material called for by industry specifications
[12] See diagram

Terminal Block Material
UV Stable Polycarbonate with flame-retardant

Resistance to heat and fire
Complies with 960 °C [13] glow-wire (IEC 60695-2-1)

Resistance to spread of fire
UL94-V0 rated @1.5mm. No toxic gases emitted: 'Green Material'[14]

Sealing

Type
Meter Enclosure
Factory sealed with screw-sealing plugs

Terminal Cover
Utility sealed with wire and crimped ferrule

Operating Environment

Area of Application
Indoor meter (according to IEC62052-11)

Operating Temperature Range
-10 °C (+14 °F) to +55 °C (+131 °F)

Storage Temperature Range
-25 °C (-13 °F) to +70 °C (+158 °F)

Relative Humidity
Maximum ≤95%; Annual mean 75%

Man Machine Interface

Type
Language-independent

Components
Pictographic/Numeric LCD display, keypad, LED rate of consumption indicator, audio feedback

Liquid Crystal Display (LCD)
Size
$9cm^2$ (45mm (W) x 20mm (H), 8 digits + 11 icons

Icon information
Happy face, Sad face, Alert, Breaker status, Info, kWh, 4-segment credit wedge
Numeric information
Display of various meter information such as credit levels, number entry, etc.

Keypad
12-key, international standard layout including "Information" and "Backspace" keys

Buzzer
Audio feedback on keypress

Light Emitting Diode (LED)
Rate of consumption indicator (Pulse rate proportional to current rate of consumption)

Diagnostic Information
Additional meter parameters accessible via the "Information" key

External Interfaces

Standard Interrogation Port
8-pin interface according to ESKOM DISSCAAA9

Optical Communications Port
According to IEC 62056-21

Proprietary Interrogation Port
Data interface for Cashpower Powerscope

Specification Compliance and Approvals

IEC
IEC62055-31

SABS
SABS 1524-1

ESKOM
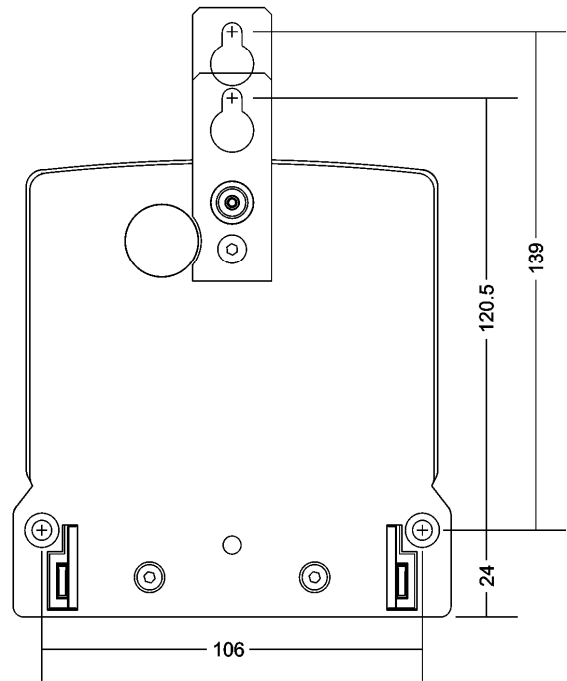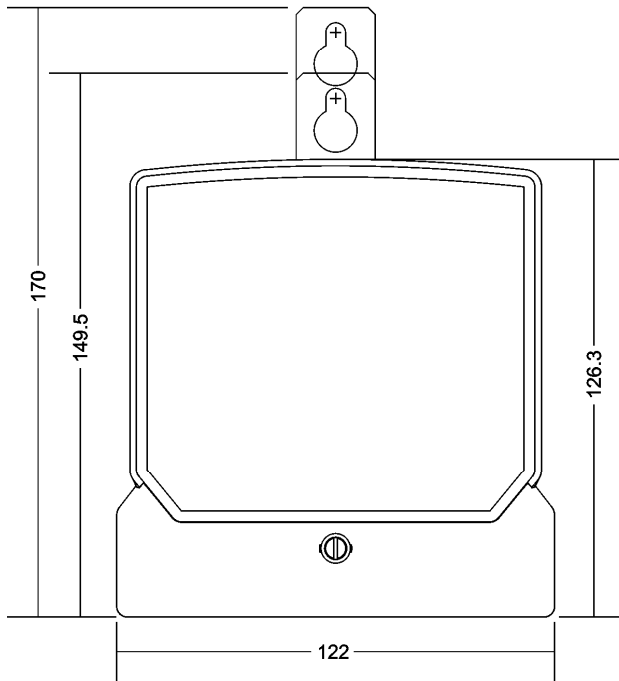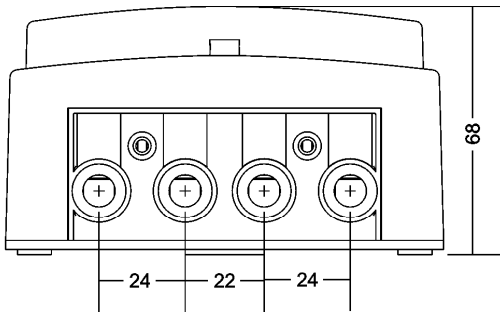Prepayment Meters ESKOM DISSCAAA9

BS
BS 5685: 1979

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[13] Only 650 °C called for by standard industry specification
[14] No V-rating or 'Green' material called for by industry specifications

Dimensions

Meter Dimensions - Short Cover

Dimensions

Meter Dimensions – Long Cover