

BEC23PLT Technical Manual

Introduction

The BEC23PLT meter is a single phase, STS compliant Prepayment Electricity Meter comprising 2 parts, these being a totally sealed metering unit and a wall base. There are different models in the BEC23 range.

Technical specifications:



This is a STS single-phase prepayment electricity meter that utilizes a common base. The data is entered by means of a keypad and the internal disconnection switch is rated to 100A. It also has a tamper switch to detect tampering on the meter.

Specifications

Voltage Range

- 220-240VAC (phase voltage) -20% +15%
- Additional voltage ranges available on request

Supply Frequency

- 50Hz + 2%
- Additional frequency ranges available on request

Current Ratings

- Maximum current:
- 80 Amps BEC23PLT
- 20 Amps BEC23PE/T
- Base current 5 Amps
- Starting current 0,025 Amps

Total Supply Burden

- Nominally 1.2W and 9.5VA

Disconnection Device

- 100 Amp single pole bi-stable disconnection switch (BEC23PLT)

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Environmental

- Operating temperature: -10°C to +55°C.
- Storage temperature: -25°C to +70°C.
- Humidity: 95% non-condensing

Accuracy

- Class 2

Enclosure

- IP51

Features

Protection

- Each phase is protected by a 5kA / 5kV surge arrestor
- Electronic circuits designed to withstand 420VAC for up to 48 hours
- Short circuit current rating:
 - 3kA (BEC23PLT)
- Load / Line Reversal Protection

Security

- Provision for lead seals or wire seals are made
- The installation is completely sealed to prevent tampering and insect ingress
- Internal register of correctly entered tokens
- Each meter has a unique security key
- Meter can be equipped with a tamper switch
- Meter can be shipped either in a commissioned state or non-commissioned state

Reliability

- Conformal-coated PCB's, protect against insect, dust and humidity
- Keypad has a proven reliability of more than one million operations per key
- Pick and place technology using surface mounted components ensures a high degree of manufacturing accuracy and repeatability

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Standards

Specifications	
IEC 62052-11	Electricity metering equipment (AC) General requirements, tests and test conditions. Part 11: Metering equipment
IEC 62053-21	Electricity metering equipment (AC) Particular requirements Part 21: Static meters for active energy (classes 1 and 2)
IEC 62055-41	Electricity metering - Payment metering systems Part 41: Standard Transfer Specification
IEC 60068-2-27	Environmental testing Part 2: Tests. Test Ea and guidance: Shock
IEC 60068-2-6	Environmental Testing Part 2: Tests - Test FC: Vibration (Sinusoidal)
IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Direct local data exchange
SANS 1524-1	Electricity payment systems – Prepayment meters
ISO 14001:2004	Environmental management systems
ISO 9001:2000	Quality management systems – Requirements with guidance for use
ESKOM SCSSCAA9	Particular Requirements for Pre-payment Meters
ESKOM TRMSCAAP2	Surge Arrestors
SANS 767-1 (BEC23PE/T)	Earth leakage protection units Part 1: Fixed earth leakage protection circuit breakers
VC 8035 (BEC23PE/T)	Earth leakage protection units

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Disconnection Device

The meter uses one 100 A, 3kA single pole load switch as the disconnection device on a single-phase meter. This disconnection switch disconnects the consumer when the credit expires or the load limit is exceeded. When the disconnection switch opens due to an overload limit being exceeded it remains open for approximately 30 seconds and then re-closes. If the overload is still present it opens again. After 5 consecutive 30-second reconnection attempts the disconnection switch will remain open for 30 minutes. This pattern is repeated indefinitely until the overload is removed. It should be noted that the disconnection switch is not designed as an over-current protection device and must not be used to interrupt fault currents.

Rate LED

The meter has a rate LED that pulses 1000 times per kWh delivered and indicates to the consumer the rate at which electricity is being consumed. It can be used, in conjunction with the Meter Interrogator optical reader and a test load to check the calibration of the meter.

The Rate LED can also be used together with the Meter Interrogator Kit to perform an optical dump. This indicates the remaining credit, user total to date, meter total to date, meter serial number and software version. In the event of meter failure the information available from the Rate LED may also be read directly using a MC171 Direct Probe in conjunction with an Interrogator Kit.

User interface

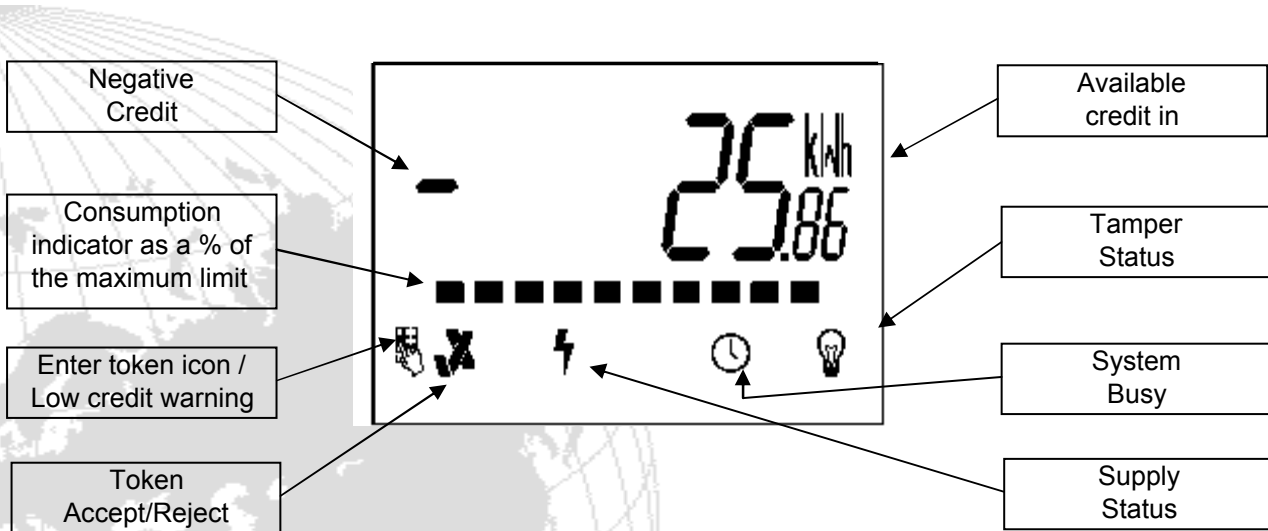
Meter interface

- Keypad user interface with tactile feedback
- A large format LCD that supports numeric, bar graphs and icons is used
- An LED indicating the rate of consumption (Flash Rate: 1000 pulses / kWh)
- Supports the optical and direct probe using the Meter Interrogator Kit



LCD interface

The meters' LCD interface has been standardised throughout the complete pre-paid electricity meters. The LCD display indicates credit available (in kWh), load indicator, overload indication, low credit warning, zero credit indication, negative credit indication, wait indication, token acceptance or rejection indication, tamper indication and special user functions.



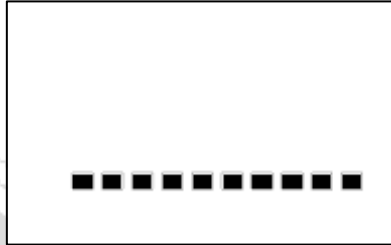
LCD Icon Display

Above is the display, as it would appear with all the segments in current use highlighted. When "display test", # 3 # #, is activated via the keypad, further icons will appear.





Overload Indication



The consumer is disconnected when the load power / current being consumed, averaged over a 15 second period, exceeds the load / current limit. When this happens all ten segments of the rate consumption bar-graph flash as an indication to the consumer to switch off appliances. The load limit is programmable allowing the supply authority to limit the maximum power an individual consumer is able to draw.




Low Credit Indication

When the low credit threshold is reached the meter will begin to flash the  icon. Only when the credit goes above the threshold will the  icon go off.

Zero Credit Indication

When the available credit reaches zero the disconnect device disconnects the load. When the credit is zero the  icon remains on continuously and the disconnect device status icon  goes off or the circuit breaker will trip.

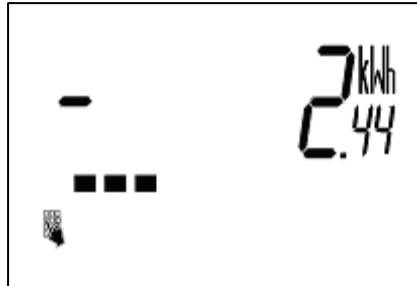
Wait (Clock) Indication

When the wait icon  appears the system is busy and the keypad is disabled. The consumer must wait until the wait icon disappears before entering data.

Negative Credit Indication


Under certain circumstances e.g. through switching delays or a faulty disconnection device, the consumer may continue drawing current after the trip point has been reached. Should the meter be configured to display negative credit values the display would include a negative sign preceding the credit value as indicated in the display below.

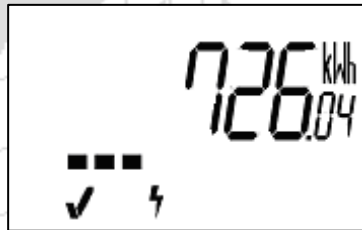





Alternatively, the meter can be configured, at the time of manufacture, so that the display continues to indicate **0.00 kWh** whilst the meter registers the negative credit in its memory. The enter credit icon continues to be displayed and the disconnection device status icon is not displayed.

Token Acceptance Indication

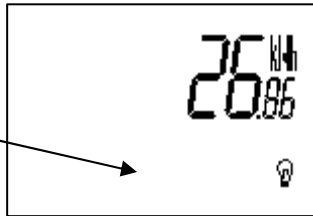
On acceptance, the display will flash the entered value. The duration for displaying the value shall be 10 seconds, thereafter reverting to its default display. The  is illuminated at the start of the message display and remains active for a period of four seconds before being extinguished. In the example below a value of 726.04kWh is being added.



Tamper Indication

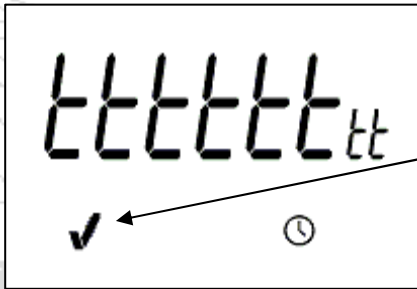
In the event that a tamper condition has been detected the meter will initiate the tamper process. The configuration flags in the options registers (set up at the time of manufacture) governs this. The meter can be configured to disconnect the consumer's supply and either display or not display the tamper detection. If configured to display the tamper status then the "Light Bulb"  icon will be displayed, as indicated in the graphic on the following page.

No ⚡ icon - supply suspended kWh



Light bulb is flashing

To clear the tamper condition a “clear tamper” meter specific management token is required. When this token is entered the display will flash all ‘t’s thereafter reverting to the normal credit display.



The tick will be visible for four seconds, thereafter the “t”s will be displayed (flashing) for a further six seconds (a total display time of 10 seconds).

Token Rejection Indication

If the token is not accepted the token rejected icon  appears for 4 seconds followed by the explanatory code flashing for 10 seconds.

Displayed on LCD	Meaning of Code
FFFFFF ff x	Meter Full
dddddd dd x	Duplicate Token
EEEEEE EE x	Data Entry Error
000000 00 x	Token Expired

Special User Functions

The following information can be obtained from the meter by entering the following hash commands via the keypad:



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Keypad Entry	Display Reading	
# 1 #	<p>Average Power in kW</p> <p>The amount of electrical power in kW's currently being used averaged over a 15 second period. It will be displayed for 10 seconds before reverting to the normal credit display. The example shows consumption of 9.21kWh.</p>	<p>1. 9^{kW}.21</p> <p>⚡</p>
# 2 #	<p>Total User Consumption To Date</p> <p>The total amount of electricity consumed by the customer, in kWh, since the last clear credit token was entered will be displayed. After 10 seconds it will revert to the normal credit display. The example shows a user total consumption to date of 47723.9kWh</p>	<p>2. 4772.39^{kW}</p> <p>⚡</p>
# 3 #	<p>Keypad Test / Display Test</p> <p>Initiating a keypad test and pressing each of the keys will test the keypad. The display will fill with characters relative to the key being tested. The example shows the key 4 having been pressed. Type: # 3 # # and the segment display test will be invoked. Once the test is complete it will revert to the normal credit display.</p>	<p>444444.4</p> <p>⚡</p> <p>8.8.8.8.8.8^{kW}</p> <p>⚡ ⌚ ⏏</p>
# 6 #	<p>Total User Credit To Date</p> <p>The total amount of credit entered into the meter since the last clear credit token was entered will be displayed. After 10 seconds the display will revert to the normal credit display. The example shows the total credit entered to be 9030.8 kWh.</p>	<p>6. 903^{kW}.08</p> <p>⚡</p>
# 7 #	<p>Meter Status</p> <p>The meter status register is displayed in bit form. After 10 seconds the display will revert to the normal credit display. Bit 0 starts on the right hand side of the LCD display, moving across to Bit 7 on the left hand side of the display. After a few seconds it will revert to the normal credit display. The example indicates a meter that has been commissioned and is not in tamper.</p>	<p>00 100 1₁₀</p> <p>⚡</p>

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Keypad Entry	Display Reading	
<p>Display Supply Group Code (SGC)</p> <p>The SGC is programmed into the meter at the time of manufacture. The example shows a SGC of 399999.</p> <p>When a key change has been performed this value is cleared to zero. It should be noted that the key change tokens do not contain any information pertaining to the SGC number, therefore the SGC register cannot be updated.</p>	<p>Display Supply Group Code (SGC)</p> <p>The SGC is programmed into the meter at the time of manufacture. The example shows a SGC of 399999.</p> <p>When a key change has been performed this value is cleared to zero. It should be noted that the key change tokens do not contain any information pertaining to the SGC number, therefore the SGC register cannot be updated.</p>	 
<p>Last 10 STS Token 20-Digit Numbers</p> <p>The most recent token entered can be selected by the hash key 11, the second most recent token by the hash key 12 and so on. The actual 20 digit token is displayed as read, from left to right.</p>	<p>Last 10 STS Token 20-Digit Numbers</p> <p>The most recent token entered can be selected by the hash key 11, the second most recent token by the hash key 12 and so on. The actual 20 digit token is displayed as read, from left to right.</p>	 
<p>Last 10 STS Token Transfer Amts in kWh</p> <p>If the information contained within the token is not a kWh value, then the class and sub-class of the token is displayed. The only token carrying kWh information is the credit. Both the power overload setting and Phase Imbalance tokens have a value depicted as kW. The graphic on the top graphic shows an example where the token does not contain a numeric kWh value; it is a clear credit token. The graphic below shows an example where the token does contain a numeric kWh value; it's a credit token of 726.04kWh. No Class or Sub-Class is shown.</p>	<p>Last 10 STS Token Transfer Amts in kWh</p> <p>If the information contained within the token is not a kWh value, then the class and sub-class of the token is displayed. The only token carrying kWh information is the credit. Both the power overload setting and Phase Imbalance tokens have a value depicted as kW. The graphic on the top graphic shows an example where the token does not contain a numeric kWh value; it is a clear credit token. The graphic below shows an example where the token does contain a numeric kWh value; it's a credit token of 726.04kWh. No Class or Sub-Class is shown.</p>	 





Engineering Tokens

There are a group of tokens used to configure the meter and perform additional special operations. The Electricity Vending Unit issues them. Some tokens will only be accepted by a specific meter (known as "Meter Specific" tokens) and may only be used once while others work in all meters ("Non-Meter Specific" tokens) and are reusable.

Clear Credit token (Meter Specific)

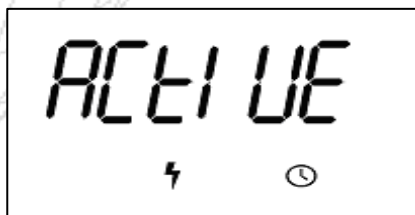
This token is used to clear the "credit remaining" register and the "user total consumption to date" register. It does not clear the "meter total consumption to date" register. This token is meter specific and may only be used once.

Clear Tamper token (Meter Specific)

If the 'Tamper Detect' has been enabled on your meter at the factory, then you might need to use this token. If a meter is removed from the common base without isolating the power to this meter, the meter will go into a tamper state. To clear this tamper state you will need to make a 'Clear Tamper' token at a vending unit, power up the meter again and enter the 20 digits. Make sure that you isolate the power from the meter before removing it from the base to avoid the meter going into this state. This token is meter specific and may only be used once.

Commissioning token (Non-Meter Specific)

The commissioning token is a non-meter specific token 1275 4194 1448 6450 5970. The meter can be configured with or without commissioning. If configured, the meter is supplied with the disconnection device open and the tamper detection circuitry inactive. On entering the token the meter will connect the consumer's supply (internal disconnection device meter) or allow the manual reset of the circuit breaker. The tamper detection will also be activated in whatever configuration is set up during production, if enabled.



The message above flashes for a period of 10 seconds once the token has been successfully entered. The token accept icon initially appears for a period of 4 seconds to indicate a valid token and the wait icon will be on while "ACTIVE" is flashing on the display. Multiple entry of this token does not change the commissioned status of the meters, however, it will display EEEEEEEE on the screen if entered more than once.

