BEC23 (05) - TECHNICAL MANUAL

Part Number: 700034708000 Rev.5

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Section 1 : Company Overview

Since the inception of the South African prepayment industry in the late 1980s, Conlog has been at the forefront of pioneering solutions that meet the needs of utilities worldwide.

The foundation of providing simple yet technologically advanced products, coupled with an ethos of ensuring our customers' success, has resulted in our leadership position.

Products for today and tomorrow

Conlog specialises in providing prepayment solutions for the delivery of electricity and water services. Our broad range of products encompasses prepayment meters, vending revenue management, support, services, maintenance, as well as the only dedicated and accredited training facility for all aspects of prepayment.

This comprehensive and holistic approach enables customers to reap the full benefit of their investment and ensures sustained success, into the future.

Global footprint

The company currently has prepayment projects operating in more than 20 countries with an ever increasing footprint that encompasses Africa, Eastern Europe, South America and South East Asia. In addition, as a subsidiary of the global Schneider Electric group, we have access to a network of offices in over 130 countries.

Platform of excellence

In all areas of the business, our goal is for absolute excellence. To this end, the company's manufacturing facilities are independently accredited with ISO 9000:2001 and ISO 14001 standards. Our products also carry the highest international standards, and the company aims for continual improvement through a variety of internal quality programmes such as six sigma.

A world of experience

Specialising in prepayment, Conlog has been providing customers with an unsurpassed depth of experience and knowledge for over 15 years. The company has received a number of accolades through the years including the inaugural Innovation Award for the prepayment industry, the Electricity Supply Industry's (ESI) Best Metering Company three years in a row, as well as recognition for its Black Empowerment.

CONLOG
Solutions for utilities

Section 2 : Introduction

The BEC23 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. These models are listed below with their technical specifications. Note the actual functionality of the different models is identical.

	**BEC23PL** 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.
	**BEC23PLT** 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.
	**BEC23PD/T** 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 disconnection switch is a double pole circuit breaker, rated to 60A.
	**BEC23PE** 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 disconnection switch is an earth leakage circuit breaker, rated to 20A.
	**BEC23PET** 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 disconnection switch is an earth leakage circuit breaker, rated to 20A. It also has a tamper switch to detect tampering on the meter.

Section 3 : 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 SCSSCAAA9	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

Section 4 : Specifications

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

Supply Frequency
- 50Hz $\pm$ 2%
- Additional frequency ranges available on request

Current Ratings
- Maximum current:
  - 80 Amps BEC23PL/T
  - 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 (BEC23PL/T)
- 60 Amp double pole circuit breaker (BEC23PD/T)
- 20 Amp double pole earth leakage circuit breaker (BEC23PE/T)

Environmental

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

Accuracy

- Class 2

Enclosure

- IP51

Section 5 : Features

Protection

- Each phase is protected by Conlog's 5kA / 5kV surge arrestor
- Electronic circuits designed to withstand 420VAC for up to 48 hours
- Short circuit current rating:
  - 2.5kA (BEC23PE/T)
  - 3kA (BEC23PL/T)
- Load / Line Reversal Protection

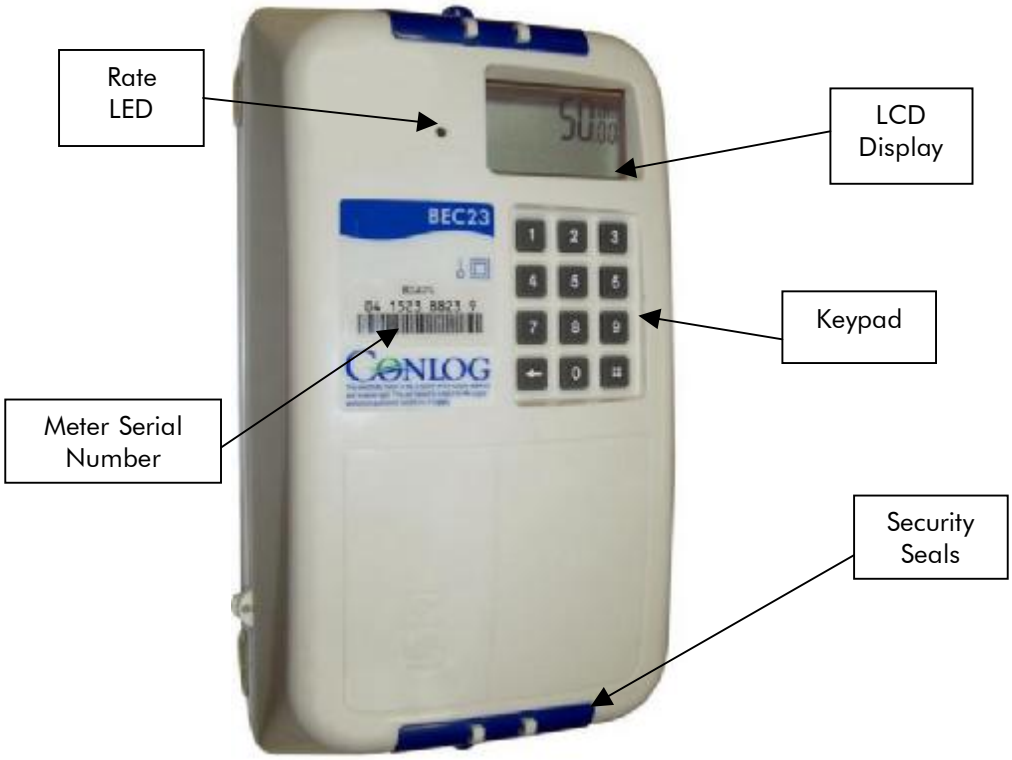
Security

- 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

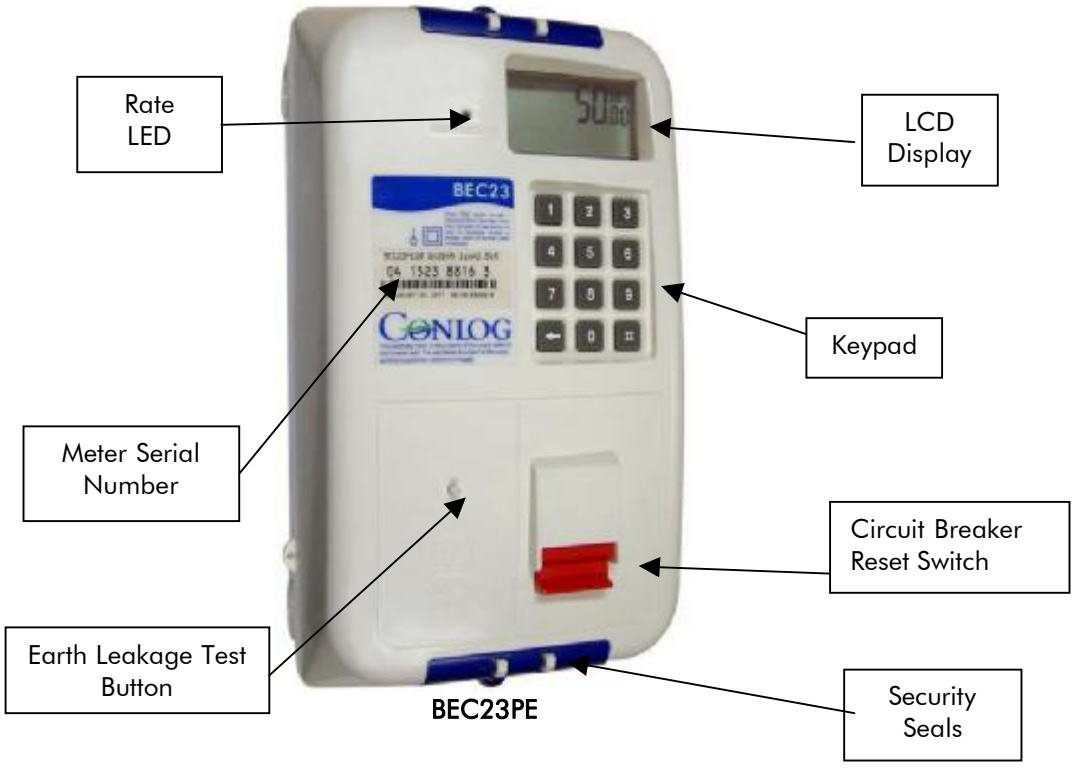
Reliability

- 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

Section 6 : Meter Overview



BEC23PL



BEC23PE

Disconnection Device

Latch type meter (BEC23PL)

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.

Circuit Breaker type meter (BEC23PD)

The meter uses one 60A double pole circuit breaker as the disconnection device on a single-phase meter.

The circuit breaker disconnects the consumer when the credit expires or the load limit is exceeded. When the circuit breaker trips due to the load limit being exceeded (overload), you will not be able to reset the breaker until the overload is removed.

Earth Leakage type meter (BEC23PE)

The meter uses one 20A double pole circuit breaker as the disconnection device on a single-phase meter.

The circuit breaker disconnects the consumer when the credit expires, the load limit is exceeded or there is a fault current detected. When the circuit breaker trips due to the load limit being exceeded (overload), you will not be able to reset the breaker until the overload is removed. If it trips due to a fault current, a qualified electrician should be called in to investigate the reason why it is tripping.

Note: With this type meter a ready board or distribution board is not necessary for the installation. The output from the meter can be connected directly to a plug socket. See Section 12, 'Typical Installation'.

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.

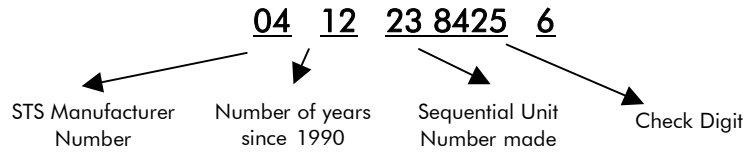
It can be used, in conjunction with the Meter Interrogator optical reader and a test load to check the calibration of the meter. The Rate LED can also be used together with the Meter Interrogator Kit to perform an optical dump. This indicates the remaining credit, user total to date, meter total to date, 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.

Meter serial number

The Meter serial number is derived as shown below:

Example:



So the interpretation of this serial number is: the meter is a Conlog meter, made in 2002 and its sequence number is 238425.

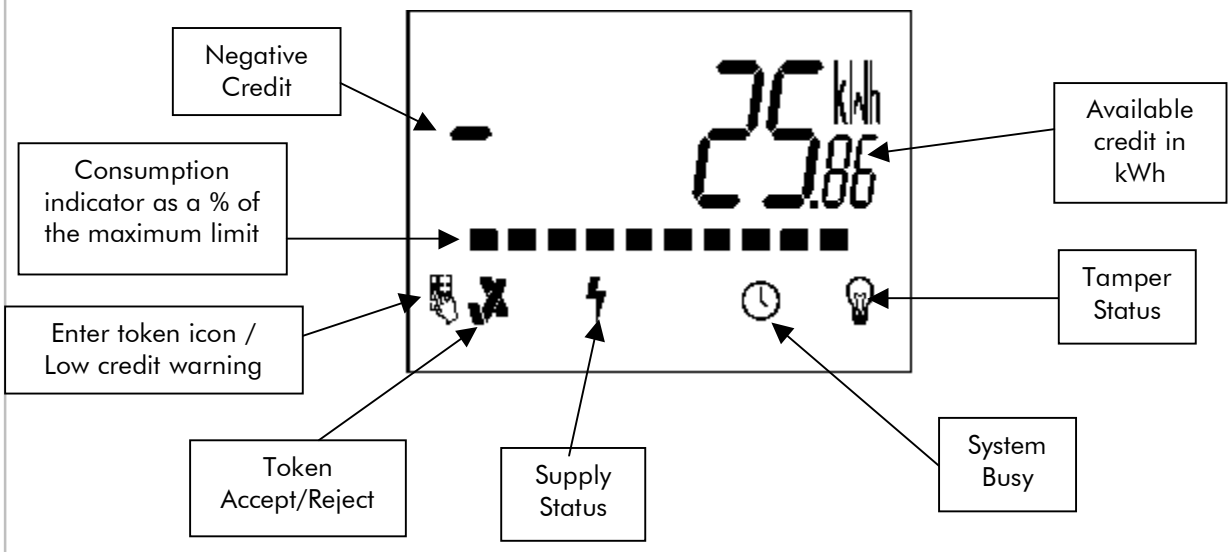
User interface

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

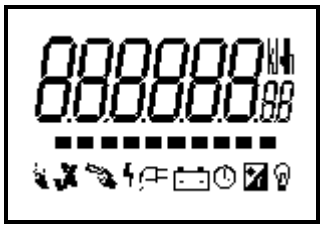
LCD interface

The meters' LCD interface has been standardised throughout the range of Conlog 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. (Refer to "Special User Functions" for details)



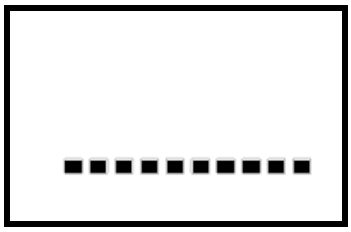
LCD Icon Display

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.

Note: The disconnect device status icon on the LCD is not available on a circuit breaker type meter (BEC23PE).

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.

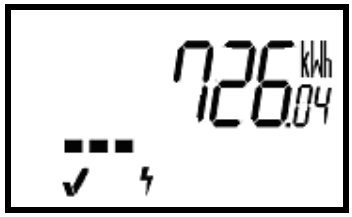
Alternatively, the meter can be configured, at the time of manufacture, so that the display continues to indicate **0.00 kWh** whilst the meter registers the negative credit in its memory. The enter credit icon continues to be displayed and the disconnection device status icon is not displayed.

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.



Token Rejection Indication

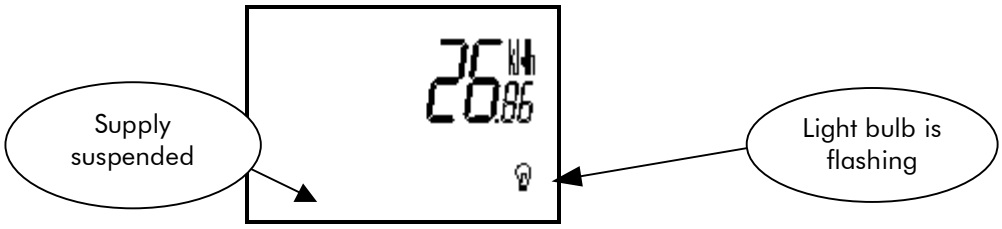
If the token is not accepted the token rejected icon ✗ appears for 4 seconds followed by the explanatory code flashing for 10 seconds.

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

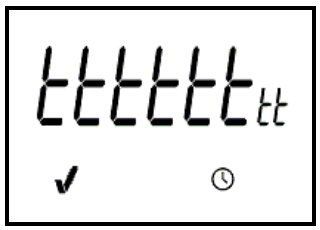
See also "Problem Solving" Section 11, for further explanation of the above codes.

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.



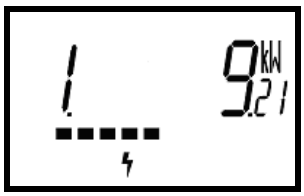
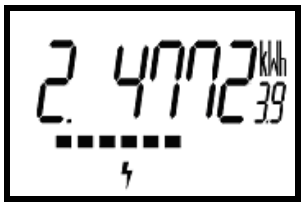
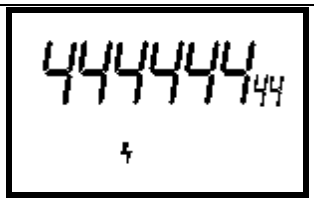
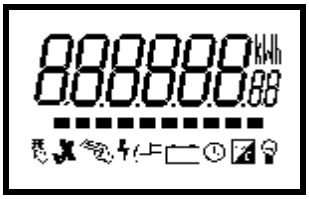
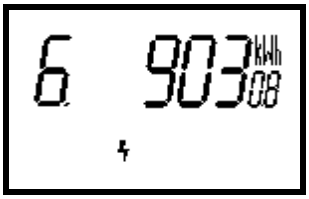
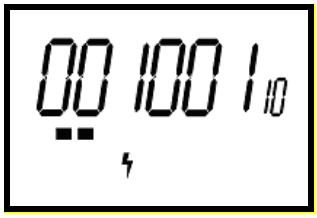
To clear the tamper condition a "clear tamper" meter specific management token is required. When this token is entered the display will flash all 't's thereafter reverting to the normal credit display.

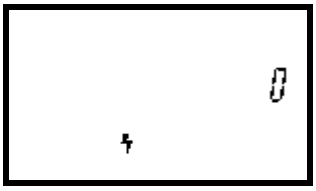
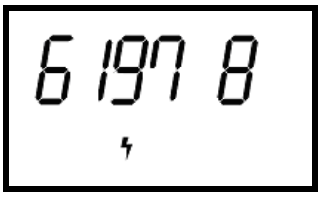
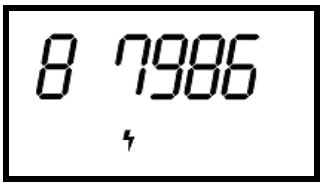
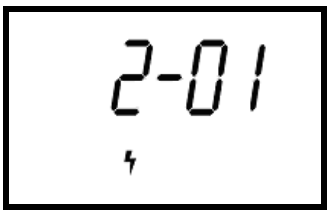
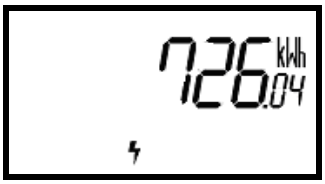


The tick will be visible for four seconds, thereafter the "t"s will be displayed (flashing) for a further six seconds (a total display time of 10 seconds).

Section 7 : Special User Functions

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

Keypad Entry	Display Reading	
# 1 #	**Average Power in kW** 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 9.21 kWh.	
# 2 #	**Total User Consumption To Date** 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	
# 3 #	**Keypad Test / Display Test** 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.	 
# 6 #	**Total User Credit To Date** 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.	
# 7 #	**Meter Status** The meter status register is displayed in bit form. After 10 seconds the display will revert to the normal credit display. The table 'Meter Status' below shows the meaning of each bit of information. 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.	

#10#	**Display Supply Group Code (SGC)** The SGC is programmed into the meter at the time of manufacture. The example shows a SGC of 399999. 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.	 
#11# To #20#	**Last 10 STS Token 20-Digit Numbers** 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.	 
#21# To #30#	**Last 10 STS Token Transfer Amounts in kWh** 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.	 

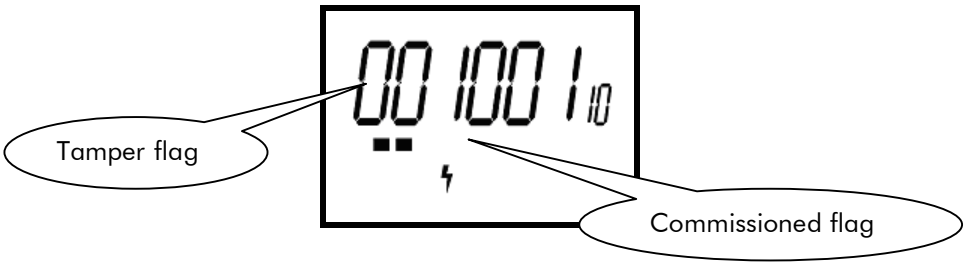
Meter Status

Type # ? # on the keypad and the meter configuration register status will be displayed. The table below shows the meaning of each bit of information. Bit 0 starts on the right hand side of the LCD display with Bit 7 on the left hand side of the display. After a few seconds it will revert to the normal credit display.

BIT	Status Flag	Detail
Bit 7	Tamper detection flag	0 = No tamper detected 1 = Tamper detected
Bit 6	Not Used	
Bit 5	Meter commissioned flag	0 = Meter not commissioned 1 = Meter commissioned
Bit 4	Reserved for Internal Use	
Bit 3	Not Used	
Bit 2	Reserved for Internal Use	
Bit 1	Reserved for Internal Use	
Bit 0	Reserved for Internal Use	

Table 1- Meter status register

The example below indicates a meter that has been commissioned and is not in tamper.



Tamper detection flag

When this flag is clear the meter has not detected a tamper condition. When set the meter has detected a tamper condition and the appropriate display / icons will be enunciated. Various operational configurations are available for the tamper detect condition.

Meter commissioning flag

The commissioning configuration flag is set or cleared during production or via the meter specific commissioning configuration token. If the flag is set (1) the disconnection device will close if all other requirements for closing the disconnection device are met. The meter will also detect tamper (if configured) whenever the meter is removed from the base. If the flag is cleared (0) the consumers' supply will be disconnected and the tamper detection functionality within the meter will be disabled (if configured).

Section 8 : 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.

Maximum Load Limit token (Meter Specific)

This token is used to adjust the load limit of the meter and is issued by the Electricity Vending Unit. The BEC23 meter with an internal disconnection device may be set from 0.23 kW to 18,4 kW. (At unity power factor, this would equate to a programmable range between 1A and 80A at 230VAC). The BEC23 meter with a circuit breaker may be set from 0.23kW to 13.8kW. (At unity power factor, this would equate to a programmable range between 1A and 60A at 230VAC). This token is meter specific and may only be used once.

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.

Key Change token (Meter Specific)

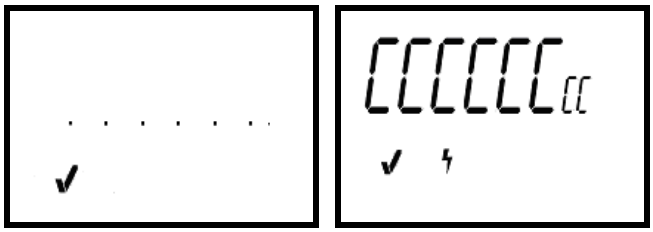
This token is used to replace the existing key with a new one i.e. when changing the Supply Group Code, Tariff Index or Key revision. It is a 40-digit number for the keypad meter.

On completion of the first 20-digit token the display announces its acceptance of the token by the normal ✓ icon, displayed for 4 seconds, while displaying the decimal points for a further 6 seconds before returning to the default display.

At this time a 4-minute timer is initiated waiting entry of the second 20-digit token. If for some reason the second token is not entered, the key will not be changed and the meter will continue to accept tokens based on the existing key.

When the second key change token has been entered the key change information is processed. If successful the following key change acceptance message is given.

The acceptance of the token is indicated by the normal ✓ icon, displayed for 4 seconds, keeping the display of the character C's for a further 6 seconds before returning to the default display.



Note: The use of this token erases the SGC display. When running a "Meter Test" token (Refer to "Meter Test Token") or #10#, the display will be zero, although the SGC is still resident in the meter.

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

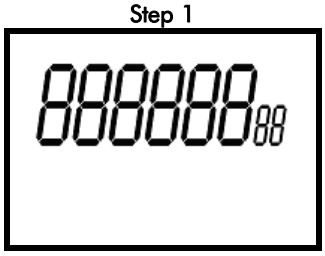
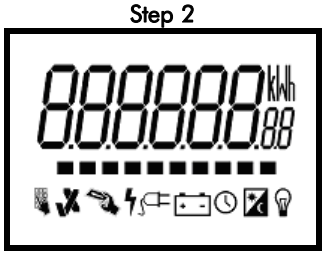
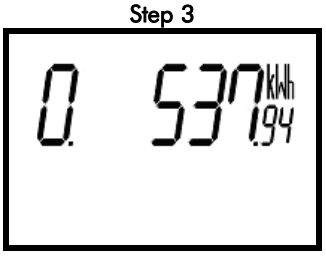
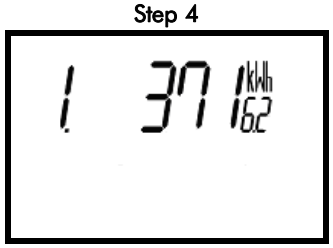
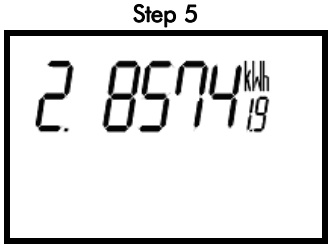
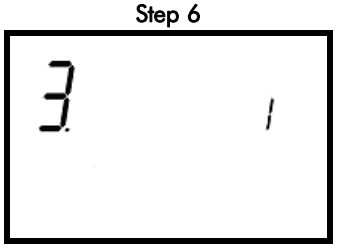
Multiple entry of this token does not change the commissioned status of the meters, however, it will display $EEEEEE_{EE}$ on the screen if entered more than once.

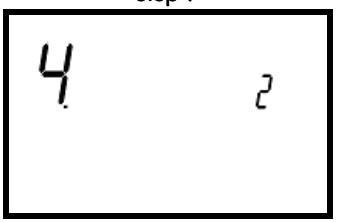
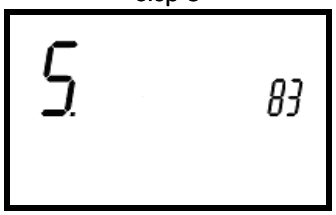
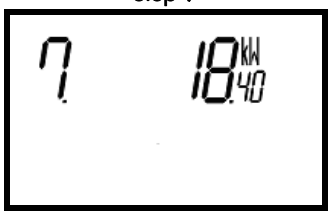
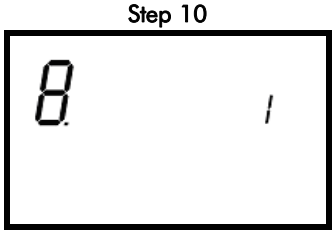
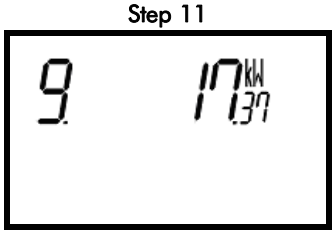
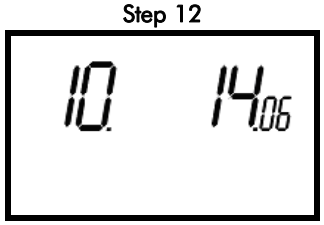
Meter Test token (Non-Meter Specific)

This token, defined as STS 0, is used to perform a series of tests on the meter.
Typing in the 20-digit code, initiates the test, which continues to step through the sequence automatically whilst displaying the data shown for each step. These steps will change from meter to meter and detailed below are the various steps that each meter will go through and what each step indicates, this is an example of the results.

Note: On a non-tamper meter, Step 10 below (8 on meter display) will not be shown, so it will jump from Step 9 to Step 11.

The 20 Digit number is: 5649 3153 7254 5031 3471.

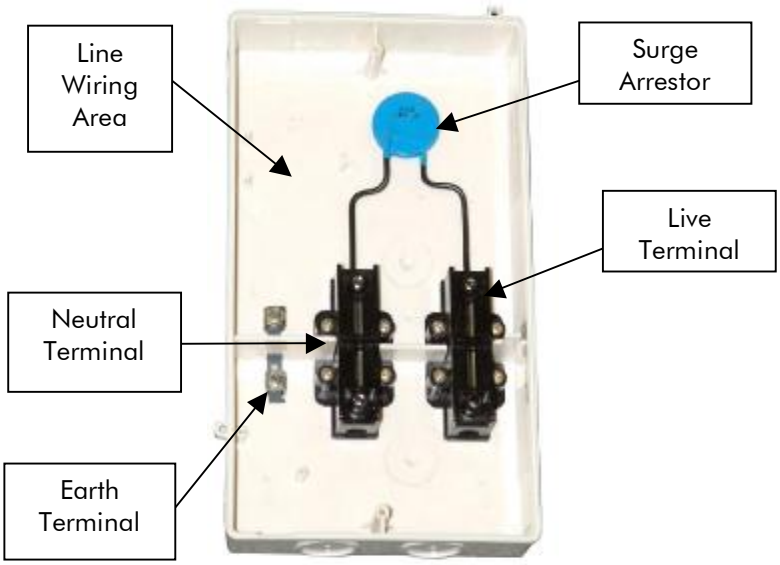
Step 1	Step 2	Step 3
		
Open contactor / trip breaker if there is credit in the meter	Perform LCD display test. Perform optical dump via rate LED	Positive credit – disconnection device opens and closes Negative Credit – disconnection device is not activated
Step 4	**Step 5**	**Step 6**
		
User Total Consumption To Date.	Meter Total Consumption To Date.	Key Revision Number.

Step 7	Step 8	Step 9
		
Key Type.	Tariff Index.	Load limit. The power in Watts
Step 10	**Step 11**	**Step 12**
		
Tamper Status 00 – Meter not in tamper mode 01 – Meter in tamper mode	Average Power Consumption.	Meter Software Revision Number. If positive credit the disconnection device will open and close again.

Section 9 : Installation of the meter

Installing the wall base

1. Determine the cable entry point and meter position (between 1.3 and 1.5m above floor level) with user.
2. Position the template in the above position not closer than 1 meter from the nearest tap and not directly above a stove or water.
3. Tape the template to the wall.
4. Drill the holes through the template with a 6mm masonry bit deep enough to accommodate wall plugs.
5. Drill holes in wall base for cables / glands.
6. Fit wall plugs and screw the wall base to the wall. Do not over tighten as this could twist the wall base.



Wiring up the wall base

Caution: The wiring is to be performed by a certified installation electrician and must conform to the prevailing Government standards and safety regulations.

1. Wire the wall base using cable glands appropriate for the installation.
2. Connect the incoming supply to the top set of terminals (above the horizontal partition).
3. Connect the live wire to the terminal on the right and the neutral wire to the left.
4. Connect the earth wire to the earth terminal.
5. Connect all outgoing wires to the bottom set of terminals. Live to the right terminal, neutral to the left and the earth to the earth terminal.
6. The outgoing wires from the wall base should be connected to a ready board, if the earth leakage type meter is not being used. Refer to Section 12 for "Typical Installations".

Note: This meter is equipped with a Line / Load Reversal Detector. If the line and load wiring is swapped around then the first time the meter draws a load in excess of 40 Watts, the meter will trip.

Testing the meter installation and sealing the unit

1. Plug the meter into the wall base by positioning the top of the meter first, hold the top in position and snap the bottom of the meter into place.
2. Screw the active unit onto the base with the screws provided
3. Restore power.
4. Enter the 20-Digit commissioning token if the meter was shipped in a decommissioned state.
5. Perform the STS 0 meter test.
6. After successful completion of the test, the meter must be sealed using both the meter plastic seals and wire seals as designated by the Supply Authority.
7. Explain the basic functionality to the customer.

Note: If you perform the STS0 meter test and the meter trips and goes "dead", it means that you have swapped the line and load wiring. Remove the meter and correct the wiring.
If the meter is "dead" when you put it into the base and it was shipped in a decommissioned state, this will also indicate that the wiring has been swapped around. Remove the meter and correct the wiring.

Removing the meter

1. Isolate the power.
2. If the power cannot be isolated ensure that all tools are insulated.
3. Remove the wire seals.
4. Taking care not to damage the front housing of the meter whilst removing the plastic seals.
5. Remove the security screws and unplug the meter from the wall base.

Note: The plastic clips can be re-used and are removed by inserting a flat screwdriver (small) under the left or right hand corner and gently lifting the clip as shown below.

Section 10 : Using a BEC23 Electricity Meter

STEP 1

Before using electricity, credit must be purchased from the nearest electricity sales point. If the meter ID card is not available the meter serial number (shown on the bar code) must be known to enable the purchase of a token.

Important:

The token can only be used for the nominated meter.

The token can only be used once.

Token Expiry: Conlog meters embody a unique token expiry system, which employs a stack of 50 tokens. Each token in the stack has its date and time recorded. Should the fifty-first token be older than the oldest token in the stack it will be rejected as an old token.

STEP 2

The 20-digit number from the token must be keyed into the meter. As the numbers are keyed in, they will be shown on the display. This allows confirmation that the numbers keyed in are the same as those on the token. If a mistake is made, use the backspace key ← to clear one number at a time until the mistake is cleared.

If it is necessary to start from the beginning again, press the key #. This will clear all the numbers entered so far and allow the re-entry of the numbers.

STEP 3

After entry of the 20-digit number, the meter will check it. If the number is valid the display will flash the amount of credit purchased for a short time and the ✓ icon will appear. The internal latch will then automatically connect the electricity or the circuit breaker can be set manually in the up direction. After a few seconds the total remaining credit will be displayed.

STEP 4

When switching on lights or any appliances, the Rate LED will begin to flash.

The more appliances switched on, the faster the LED will flash. This indicator will act as a reminder to switch off appliances that are not in use.

STEP 5

When the credit level starts running low (below 25.5kWh), the  icon on the display will start flashing. This is a warning that another token must be purchased. If the meter runs out of credit, the internal latch or the circuit breaker will trip and disconnect the electricity supply. To reconnect the electricity supply, a token must be purchased and the 20-digit number from the token keyed into the meter.

Section 11 : Problem Solving

Token Problems

Invalid token

When a token has been entered and found to be invalid the display will indicate this by flashing the following message;

This message flashes at a rate of once per second for a period of 10 seconds, then clearing for five seconds before reverting to the default display.

The icon is activated at the start of the message display and stays on for a period of 4 seconds.

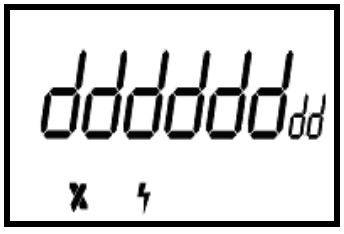
One of the following reasons could be why a token is invalid:

- The meter serial number on the token doesn't match the physical meter number on the meter.
- The tariff index on the token is not the same as the tariff index as programmed into the meter.
- The supply group code that the token was made on differs to the supply group code in the meter.
- The token was entered into the meter incorrectly.
- The key revision number of the token differs to the key revision number as programmed into the meter.
- The meter might be in a tamper status.
- The commissioning token has been entered into a meter that is already commissioned.

Check the printout of the token and then if necessary run the STS0 meter test token to compare the parameters of the meter. All the information should be validated to ascertain why the token didn't work.

Used / Duplicate token

A token entered with a Token ID that already exists in the token transaction table will be rejected as a "used" or "duplicate" token. The display will indicate this condition by flashing the following display for a period of 10 seconds. All active icons and segments of the bar graph will remain unaffected.

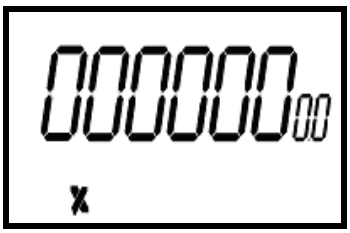


On completion of this display the meter will revert to its default display.

The icon is activated at the start of the message display and stays on for a period of 4 seconds. This token can be thrown away.

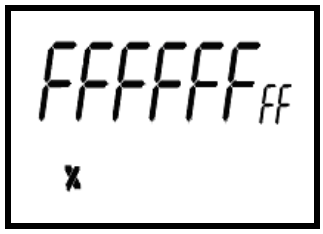
Expired token

A token with an ID that is older than the oldest token in the meter's token ID table will be rejected as an "expired token". The display will flash the following indication for 10 seconds before reverting to the default meter display. This token can be thrown away.



Meter Full

In the situation where the credit being entered would take the credit remaining over the limit of the meter the meter will display the "FULL" message.



The credit will not be added and the token ID will not be put in the table, thereby allowing the token to be entered at a later stage when the sum of the remaining credit and the added credit will not be in excess of what the meter can handle.

Meter Problems

Question The meter trips and there is still credit remaining.

Answer The meter may have been overloaded by the use of too many appliances at once.

Turn off all appliances and the meter should reconnect automatically if it has an internal disconnection switch or re-set the circuit breaker manually. Turn the appliances on one by one, if it trips out again, it could mean one of the appliances is faulty or you are definitely exceeding the maximum load limit.

Question The meter trips and there is still credit remaining.

Answer If the meter has been enabled for tamper, it could be that the meter has gone into a tamper state. This will be depicted by the enter credit icon being on permanently and the tamper icon will be flashing. You will need a clear tamper token from the vending unit to get this meter out of the tamper status.

Question Should the meter show a negative credit?

Answer No, it is a prepayment meter and should not display a negative credit. The supply authority should be contacted if the meter displays a negative value.

Question There is no credit on the meter, but electricity is still being delivered.

Answer It could be that the meter has been by passed, look for indications that there has been tampering with the meter seals. It could also mean that the meter has been set not to display negative credit at the factory.

Question What happens when the icon appear on the display?

Answer When the icon is on the display it means the meter is processing information and the keypad will be disabled, wait for the symbol to disappear before proceeding.

Question The display is blank

Answer It could be the key has been depressed. The display reverts to blank for approximately 15 seconds when is typed and not followed by further entries. Type and the display will revert to its normal state. The display could also be faulty, check the display by pressing . If nothing happens call the supply authority

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Question When running a STS0 meter test token the meter dies. What could cause this?

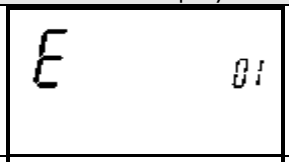
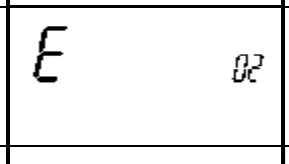
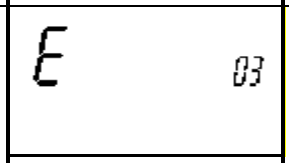
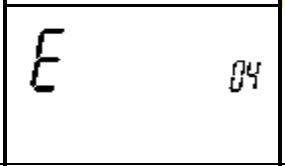
Answer The Line and Load wiring has been swapped around, hence when the internal disconnection device or circuit breaker opens, during the running of the test, it removes power from the internal electronics of the meter thus the meter shut downs. Remove the meter and correct the wiring.

Question When putting a meter in the wall base there is no power on the meter. The upstream breaker is on and there is power in the wall base.

Answer The Line and Load wiring has been swapped around, and the meter has left the factory with no credit or in the decommissioned state. This means the internal disconnection device or circuit breaker is open therefore there is no power to the internal electronics of the meter thus the meter doesn't power up. Remove the meter and correct the wiring.

Error Codes on Meters

Tabled below are error codes that could appear on the meter display. These error messages will normally indicate a severe malfunction of the meter and the meter would normally have to be returned to the factory in Durban for corrective action. An example of the actual screen error is shown below the table.

Error Code on Display	Corrective Action
	Send meter back to Conlog
	Send meter back to Conlog
	Send meter back to Conlog
	Send meter back to Conlog
	Send meter back to Conlog
	Send meter back to Conlog
	Check communications cable

Section 12 : Typical Installation

As can be seen from the diagram below, this is what a typical BEC23 (> 20 Amps) installation looks like. The meter is mounted on the left hand side of the ready board. The ready board is to the right that comes pre-wired with a common base, earth leakage, a light and three plug points.

As can be seen from the diagram below, this is what a typical BEC23PE (< 20 Amps) installation looks like. The meter is mounted on the left hand side of the 4X4 plug box. No external earth leakage device is needed as the meter has a built in 20 Amp earth leakage circuit breaker.

Note: Under no circumstance is this method to be used if the meter is not a BEC23PE.

Section 13 : Glossary Of Terms

B	BEC	Budget Energy Controller. See Meter.
C	Circuit Breaker	It is a disconnection device for a meter. It has two contacts that isolates' the incoming supply (Line), Live and Neutral wires from the out going supply (Load) Live and Neutral wires.
	Commissioning Token	This token is used to commission a meter when it is installed. It will activate the disconnection device and the tamper device in the meter. If this token isn't played in a new meter the meter will not function.
	Contactor	See Disconnection Device
D	Direct Probe MC171	A contact type probe with a circular pin configuration conforming to the requirements of the Eskom specification MC171. It is used in conjunction with an Interrogation Kit to extract information from a meter that can no longer be powered up.
	Disconnection Device / Switch	It is a device that isolates the incoming supply (Line) Live wire from the out going supply (Load) Live wire. It could be in the form of a latch, contactor, relay or circuit breaker
E	ED	See Meter
	Earth Leakage	This is a device that will protect the end users from an electrical shock in the event of a fault current. A fault current is seen as a current exceeding 30mAmps flowing between the Live connection and the Earth connection.
	Engineering Tokens	These are specialised STS tokens that can only be made by an operator who has been granted permission. The engineering types are as follows: • Meter Test • Maximum Power Load • Clear Credit • Clear Tamper • Key Change Any Conlog or STS Meter will accept the above engineering tokens.
F	Field Service Terminal	This function will allow you to import a file from the Conlog Interrogator Kit program into the management system.
I	Icon	Pictorial representation of a function and used as part of a display
	ID Card	See Swipe Card
	Interrogator Kit	A collection of parts used together with a Notebook PC to obtain parameters embedded in a meter.
K	KRN	Key Revision Number.
	Keypad	The device on a meter, which allows you to interface to the meter using numerical buttons. This interface allows you to enter tokens into the meter as well as activating special use functions.
	Key Change Token	Key change tokens are produced for a specific customer when selecting this function. These tokens are used to update the Key Revision Number; Tariff Index and/or Supply Group Code stored in a customer's meter.
L	LCD	Liquid Crystal Display
	LED	Light Emitting Diode

	Lead Seal	This is a piece of wire that is threaded through pre-manufactured holes in the meter and then bought together and bonded with a piece of lead. The lead is usually marked with logo or initials of the utility or electrician sealing the meter.
	Line	Line refers to the incoming supply to a meter.
	Load	Load refers to the outgoing supply from a meter.
	Load Switch	See Disconnection Device
M	**Meter**	This refers to the metering device, which is placed inside the customer's home or premises. The meter allows the drawing of electricity or water to the value of credit available on the meter. Also known as a Water Meter or Electricity Meter.
	Meter ID Card	A plastic meter ID card is the card supplied (with every electricity meter) to a customer. The card contains the customer's specific information, such as Tariff index and the meter serial number. This card may be used to accurately capture the customer's data when the customer makes a credit purchase. Customer information may however be given verbally. An authorised Operator can produce Meter ID Cards, on a Magstar.
	Meter Number	Refers to the unique number of the meter determined by the manufacturer. It appears on the front legend plate on the meter and is programmed in to the meter memory. Conlog proprietary meters have a 7-digit serial number that is preceded by a prefix 'C'. STS meters are characterised by an 11-digit serial number. (This number, the swipe card or an old token is required when purchasing tokens).
	Meter Specific	Refers to a token that will only work in the meter that has that specific meter number, SGC, KRN and tariff index.
N	**Non Meter Specific**	Refers to a token that will work in any meter. Such as the meter test token or the commissioning token.
O	**Optical Probe**	A probe, which uses the rate LED on the meter to optically pick up the data from the meter and dump into the interrogation kit, during the meter test token initiation.
P	**PPM**	**P**re-**P**ayment **M**eter. See Meter.
	Pre-payment Meter	See Meter.
R	**Rate LED**	This LED indicates the rate at which the end user is consuming electricity. The faster the LED flashes the more the end user is consuming and visa versa. For every 1000 pulses 1kWh is consumed.
S	**SM**	See Security Module
	SGC	See Supply Group Code
	STS	**S**tandard **T**ransfer **S**pecification, which defines the standard token coding method and format.
	STS Token	Tokens that are made to work in meters that use the STS algorithium. The encrypted data that is used to load credit into a meter. Can be either a pushbutton token (20 numeric digits printed out on a printer) or a magnetic token (a paper token with the 20 digits encrypted onto the magnetic strip on to back of the token).
	Security Key	See Supply Group Code
	Security Module	This is a security device that has the SGC's for a particular utility programmed into it. It also contains the encryption algorithm used for manufacturing STS tokens as used by STS electricity meters.

	Security Seal	These are seals that are used to protect a meter from tampering, normally if these seals are broken or tampered with in any means, the liable owner can be prosecuted for fraud. These seals are either in the form of wire, lead or plastic.
	Serial Number	See Meter Number
	Supply Group Code	This is a 6-digit number programmed into a STS meter, which serves the same function as the Project Code in a proprietary meter. The SGC restricts the sale of electricity by using this code as part of the encryption technique at the time of the meter coding and at the time of a token sale.
	Swipe Card	Also known as the ID card. It is a non-disposable magnetic card with the customer's meter serial number embossed on the front and encoded on the magnetic stripe together with the Supply Group Code and meter tariff index.
T	**Tamper**	Refers to the illegal opening or modifications of a meter. If a meter is fitted with a tamper device then the meter will shut down if tampered with.
	Tariff Index	This index is programmed into all STS meters. It provides an indication of the tariff rate applicable to the consumer. The Vending Unit is able to store up to 99 different tariff rates, per SGC, in its database.
	Test Load	A resistance of known value used with an Optical Probe to check the calibration of a meter.
	Token	This refers to the disposable push-button token issued to the customer's. The push-button tokens consisting of 20-digits are printed on an audit / slip printer and are discarded after use.
W	**Wall Base**	The passive back section of an installation that houses the connection terminals for the line and load cables and the surge arrestor.
	Wire Seals	See Lead Seal or Security Seal

Section 14 : Technical Specifications

Voltage Range	220-240VAC (phase voltage) -20% +15% Additional voltage ranges available on request	
Supply Frequency	50 Hz ± 2% Additional frequency ranges available on request	
Current Ratings	**BEC23PL** Maximum current (I_{max}) 80 A Base current (I_b) 5 A Minimum current (0,005 I_b) 0,025 A	**BEC23PE** Maximum current (I_{max}) 20 A Base current (I_b) 5 A Minimum current (0,005 I_b) 0,025 A
Supply Burden	Nominally 1.2W & 9.5VA	
Disconnection	**BEC23PL** 100 Amp, single pole bi-stable load switch	**BEC23PE** 20 Amp, double pole circuit breaker
Accuracy	Class 2 meter in accordance with IEC 62053-21 Maintained throughout life cycle of product	
Over Voltage Rating	420VAC for up to 48 hours	
Short Circuit Rating	**BEC23PL** Short-circuit current 3kA	**BEC23PE** Short-circuit current 2.5kA
Environmental	Operating temperature: -10°C to +55°C Storage temperature: -25°C to +70°C Humidity: 95% non-condensing Degree of protection IP51	
Customer Displayed Information	Status of incoming supply Available credit Disconnection status (BEC23PL) Low credit warning Token accept/reject Consumption rate LED Last 10 STS tokens entered Meter status register	
Decryption Algorithm	Credit is transferred using a 20 digit token entered on the keypad The credit is transferred in kWh Meter specific credit tokens Management and engineering tokens STS Compliant (Standard Transfer Specification)	
Installation	Meter utilises standard wallbase Easy installation, two fixing screws Two sacrificial security seals and 2 wall base seals Stainless steel wire and ferrule seal (optional extra)	
Functional Product Components	Electricity measurement circuit Consumer electricity supply disconnect Tamper detection circuit (optional) LCD consumer display interface Lightning protection (on the wallbase) Keypad customer interface Autonomous earth leakage circuit (BEC23PE)	
Other Functions	Rear entry direct probe port Optical reader to check meter accuracy Comprehensive earth leakage protection (BEC23PE)	

Standards	IEC 62052-11 IEC 62053-21 IEC 62055-41 IEC 60068-2-27 IEC 60068-2-6 IEC 62056-21 SANS 1524-1 ISO 14001:2004 ISO 9001:2000 ESKOM SCSSCAAA9 ESKOM TRMSCAAP2 SANS 767-1 (BEC23PE/T) VC 8035 (BEC23PE/T)

Section 15 : Contact Information

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Fax:	+27 (31) 268-1500
Email:	corporate@conlog.co.za
Website:	www.conlog.co.za