

BEC33HC - TECHNICAL MANUAL

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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.



Section 2 : Introduction

The BEC33HC is a three-phase high current, four wire, and STS compliant split prepayment electricity meter and is ideal for light to medium industrial applications and large office complexes. The BEC33HC comprises a user interface with tactile feedback called the User Interface Unit (UIU) and the Measurement Control Unit (MCU), which contains three single pole bi-stable 250 Amp disconnection switches with automatic re-connection. The MCU should ideally be mounted in a sub station or indoors. The UIU is mounted inside the customers' premises for convenient access.



BEC33HC



UIU

Section 3 : Standards

The BEC33HC is certified, and conforms to, the following standards (where applicable):

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 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
ISO 14001:2004	Environmental management systems
ISO 9001:2000	Quality management systems – Requirements with guidance for use
ESKOM TRMSCAAP2	Surge Arrestors

Section 4 : Specifications

Voltage Range

- 220-240VAC (phase voltage) - 20% +15%
- 380-415VAC (line voltage) - 20% +15%
- 110-127VAC (available on request)

Supply Frequency

- 50 Hz \pm 2%
- 60 Hz \pm 2% (available on request)

Current Ratings

- Current rating: 227A @ 55°C and 250A @ 30°C
- Base current (I_b): 30A
- Starting current (0.005 I_b): 0.15 A

Supply Burden

- Nominal 2.5W & 18VA (per phase)

Disconnection Device

- Three 250 Amp single pole bi-stable load switches

Accuracy

- Class 2

Environmental

- Operating temperature: -10 °C to +55 °C
- Storage temperature: -25 °C to +70 °C
- Humidity: 95% non-condensing
- UIU IP rating: IP51 [Protected against dust and vertically dripping water]
- MCU IP rating: IP54 [Protected against dust and water splashing]

Section 5 : Features

Protection

- Each phase is protected by a 5kA / 5kV surge arrester
- The electronic circuits are designed to withstand 420VAC for a period of up to 48 hours
- Designed to withstand 600VDC for a period of one minute
- The meter is equipped with thermal protection on the terminals, enhancing product safety and the meters life cycle
- The meter is designed to suspend electricity supply under power overload conditions
- Short time over current protection of 7.5kA

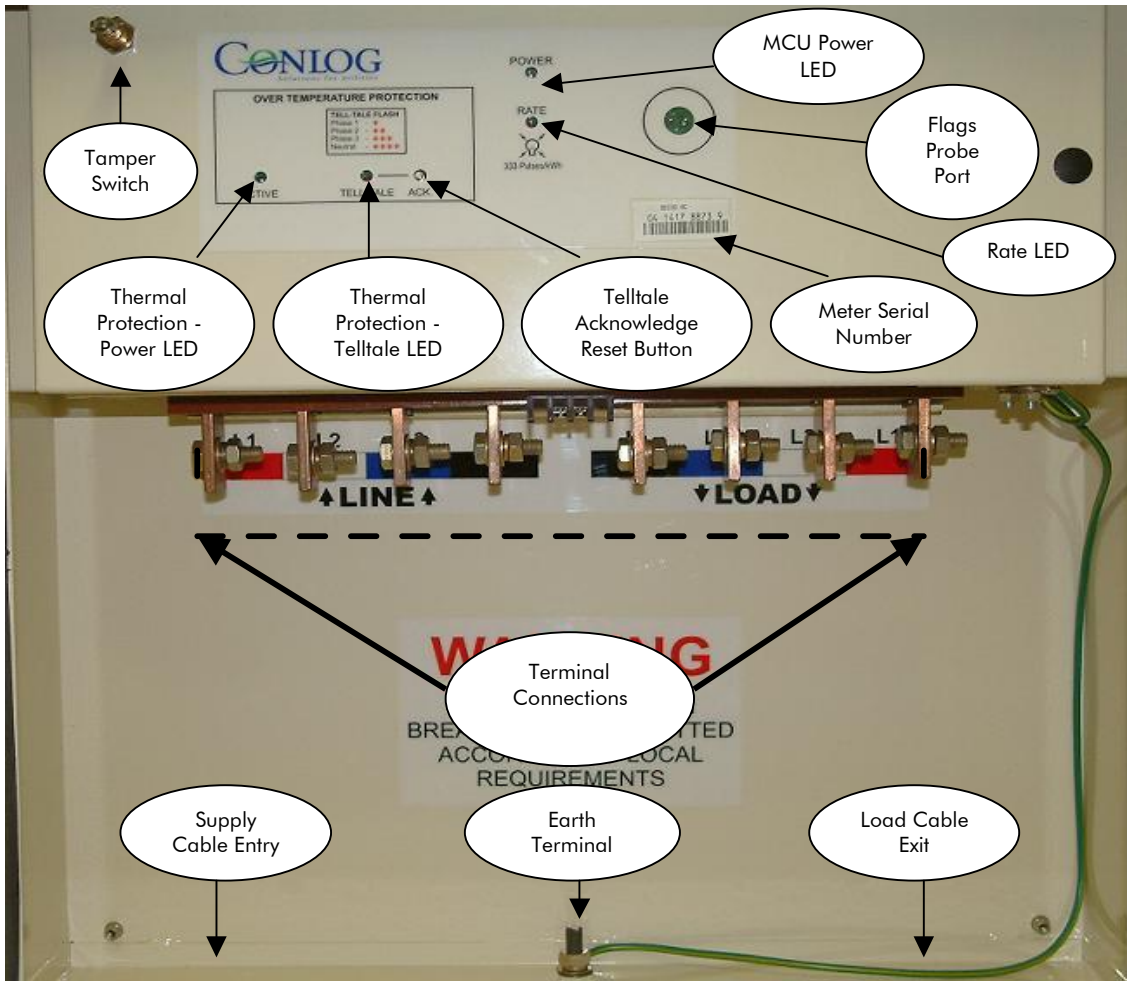
Security

- Provision for serialized security seals is combined with a security padlock
- The active unit (MCU) is completely sealed to prevent tampering
- The UIU can display the tamper status of the meter
- Internal register of correctly entered meter specific tokens to prohibit the replaying of tokens
- Each meter has a unique meter security key
- Tamper detection is available by means of a robust micro switch, which will be triggered when the enclosure door is opened
- Meter commissioning at installation (Optional)

Reliability

- Conformal-coated PCB's, ensure protection against the ingress of insects, dust and humidity
- The UIU 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
- Meter accuracy maintained over the life of the product

Section 6 : Meter Overview



Disconnection Device

The BEC33HC uses three 250 Amp, 7.5kA single pole bi-stable load switches (hereafter generically called the disconnection switch).

This disconnection switch suspends the electricity supply to the consumer under the following conditions:

- When the credit expires
- When the load limit (power) is exceeded
- When the differential load on any two phases exceeds the load unbalance setting
- When a tamper condition is detected
- When the terminal temperature exceeds 95°C

The meter supports the following overload supply suspension algorithm:

- When a load limit has been detected (current or power overload), the meter will suspend the supply for approximately 30 seconds and then auto reconnect. If the overload condition is still present the supply will be suspended for a further 30 seconds. After five consecutive 30-second supply suspensions the disconnection switch will lock out the consumer's supply for 30 minutes. This pattern is repeated indefinitely until the overload condition is removed.
- This algorithm does not apply to thermal overload and this functionality cannot be disabled.

Note: The disconnection switch is not designed as a protection device and should not be used to interrupt fault currents. It is imperative that this meter is installed with upstream and downstream breakers to interrupt any fault currents that may occur.

Rate LED

The MCU and UIU have LED's, which pulses at a rate of 333 pulses per kWh delivered and indicates the rate at which electricity is being consumed

The rate LED on the MCU can be used in conjunction with the meter interrogator kit, optical probe, and a calibrated load, to check the approximate accuracy of the meter.

Flags port probe

This port affords the field technical staff the ability to communicate and retrieve information from the meter while in the field. The port uses the Meter Interrogator kit and the flags probe to extract information from the meter. The protocol implemented conforms to the IEC 62056-21 specification.

MCU Power LED

This LED gives an indication of the status of the meter's power supply. When the line voltage is sufficient to render the meter operational the Power LED will flash at a rate of one pulse per second.

Thermal Protection Power LED

This green LED indicates if the thermal protection circuitry is operating correctly.

Telltale Acknowledge Reset Button

This button is used to reset the thermal overload status condition if the thermal overload no longer exists. Refer to Section 7 "Thermal Protection" in this manual for more information.

Thermal Protection Telltale LED

This red LED will indicate of which phase caused the thermal overload of the meter. This phase can be checked to make sure that the connections are properly secured.

Thermal Protection

If the temperature on the terminal of a specific phase rises above the preset limit, the meter will disconnect the load to avoid damage to the meter. You are able to see which phase on the meter caused this disconnection by the RED telltale temperature LED.

The number of flashes of the telltale LED indicates the phase that over heated as shown in Table 1. If the temperature on that phase drops below the threshold again, the meter will reconnect the load but the telltale LED will continue to flash indicating the phase that caused the problem.

The telltale LED will reset when a user presses the ACKNOWLEDGE button. If the ACKNOWLEDGE button is pressed and there is no thermal overload, the telltale LED will come on permanently and when released it will go off. If the ACKNOWLEDGE button is pressed and there is a thermal overload, the telltale LED will flash quickly and when released it will resume the telltale indication as show in the Table 1 below.

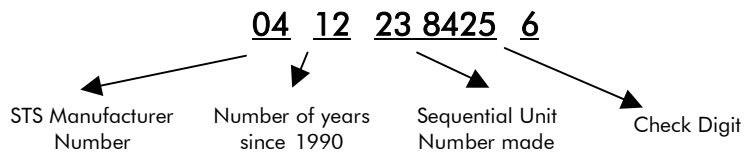
Phase	Telltale
1	1 Flash off for 5 seconds
2	2 Flashes off for 5 seconds
3	3 Flashes off for 5 seconds
Neutral	4 Flashes off for 5 seconds

Table 1 - Telltale Codes

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

The UIU is installed in the consumer's residence or building with two communication wires that are connected to the MCU (normally located outside the building). The UIU comes in a two-part construction, the base and the numeric keypad and display. The numeric keypad is used to enter tokens and initiate user functions. The LCD display indicates the appropriate information for the user. (Refer to 'Special User Functions' for more details).



UIU Installation base



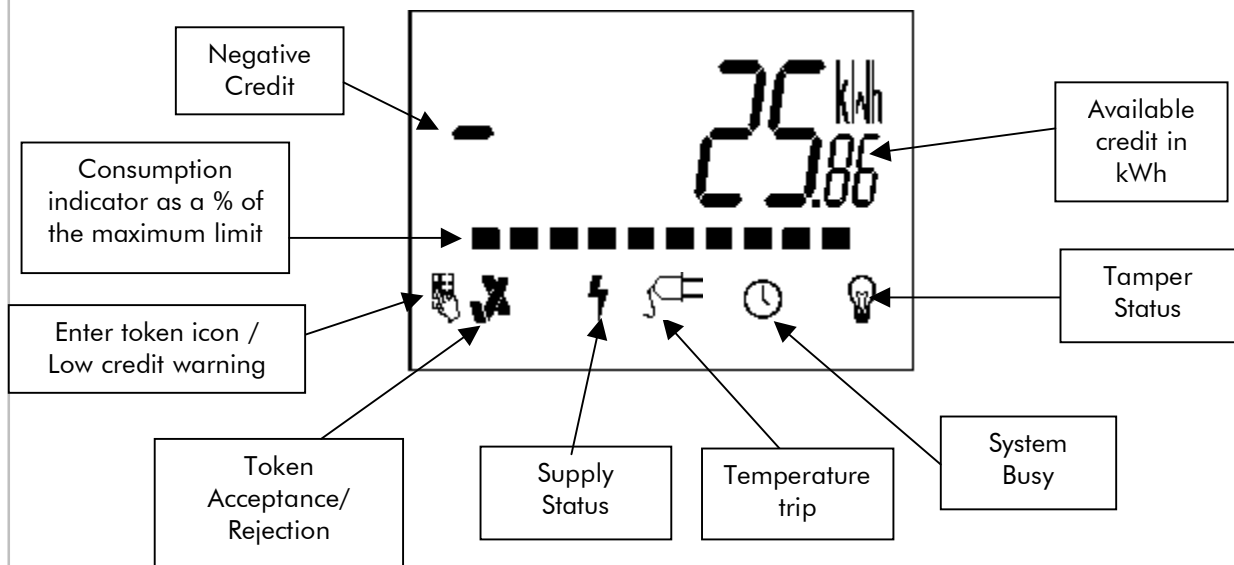
User Interface Unit

Meter interface

- Soft touch keypad with tactile feedback
- A large format LCD that supports seven segment numbers, bar graphs and icons
- An LED indicating the rate of consumption. (Flash Rate: 333 pulses / kWh).
Note: This rate LED cannot be used for meter accuracy verification
- Supports the optical probe using the meter interrogator kit for data dump (from the MCU)
- Optional audible feedback

LCD interface

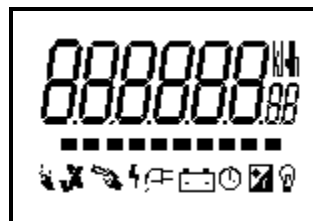
The meters' LCD interface has been standardised throughout the range of Conlog electricity meters. The LCD display indicates credit available (in kWh), consumption as a percentage of the maximum allowable consumption, overload conditions, low credit warning, zero credit, negative credit indication, system busy, token acceptance or rejection indication, tamper detection, and special user functions.



Note: Each segment on the consumption indicator bar represents 10% of the maximum permissible load. (E.g. If the overload threshold is set to 16.4kW then each segment represents 1.6kW).

LCD Icon Display

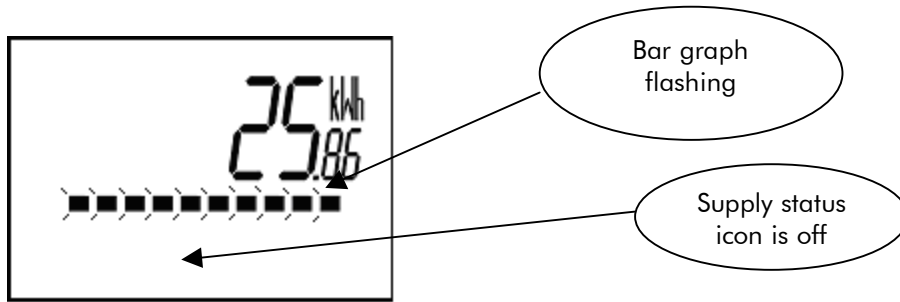
Above is the display, as it would appear with all the segments in current use highlighted. When "display test", **#3#**, is activated via the keypad, further icons will appear.



Overload Indication

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



The following graphic is an indication of the display. Note that the supply status icon is not active indicating that the consumer's supply has been suspended. The remaining credit continues to be displayed. The LCD display does not automatically indicate the cause (or value) of the overload condition.




Low Credit Indication

The keypad or magnetic token icon will begin flashing when the credit falls below 25.5kWh, thus indicates low credit.

Zero Credit Indication

When the available credit reaches zero the disconnection switch suspends the supply of electricity to the consumer. The "enter token" icon, , will be permanently displayed and the "supply status" icon, , will disappear.

Wait (Clock) Indication

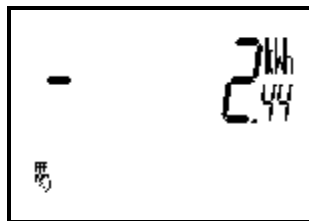
When the "system busy" icon, , appears the keypad is disabled. The consumer must wait until the icon disappears before entering data.

Negative Credit Indication

Under certain circumstances e.g. through switching delays or disconnection switch failure, the consumer may continue consuming power after all remaining credit has been consumed. This consumption is registered in the meter as negative credit and is displayed as a negative reading.

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 token" icon continues to be displayed and the "supply status" icon is not displayed.

An example of a negative credit display is given below:

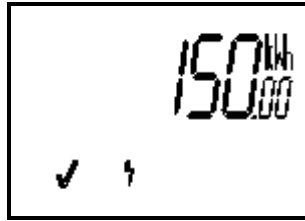


Note: When credit is entered into the meter the negative credit value is first deducted from the credit entered and only the balance will be displayed on the LCD.

Token Acceptance Indication

The "token accepted" icon, ✓, appears briefly after the consumer finishes keying in a 20 digit token and the token is accepted. A "tick" will be seen and the value of the token in kWh will flash on the display for 10 seconds.

The following graphic indicates a successful 150 kWh token entered into the meter.



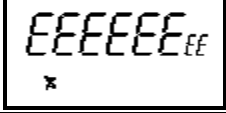



If the audible feedback option is installed a short 60 millisecond beep will be heard.

Token Rejection Indication

If the token is not accepted the "token rejected" icon, ✗, appears for 4 seconds. Simultaneously an explanation code will be displayed as illustrated below. The error code will flash on the display for a period of 10 seconds.

The following table shows the error codes that could be displayed.

Displayed on LCD	Meaning of Code
	Meter Full
	Duplicate Token
	Data Entry Error
	Token Expired

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

If the audible feedback option is installed the meter buzzer will sound continuously for one second during any one of the above conditions.

Commissioning token

This token applies to the BEC33HC. The meter can be supplied in a de-commissioned state such that it will not detect tamper or connect the consumer's supply during the meter installation and testing process.


When the meter has been installed the cable terminations can be checked prior to closing the front door. The incoming supply can be applied to the meter with the front door opened and the meter will not go into tamper.

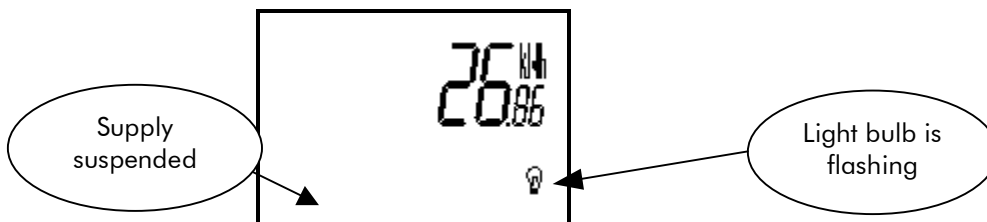
The front door can be sealed with the appropriate seals. The commissioning token is then entered and thereafter the meter will detect tamper (assuming this option was configured at the factory) and the consumer's supply will be connected.



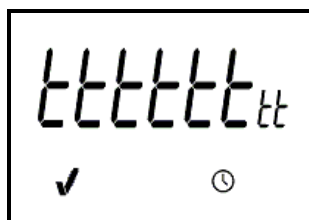
When entering the commissioning token the display shown above will be observed for a period of 10 seconds. The token accepted icon will also illuminate for four seconds to indicate a valid token entry. The commissioning token number is: **1275 4194 1448 6450 5970**

Tamper status display / status clear

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.





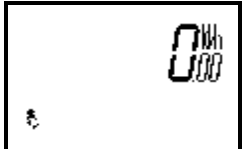



To clear the tamper condition a "clear tamper" meter specific management token is required. When this token is entered the display will flash all 't's thereafter reverting to the normal credit display.



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).

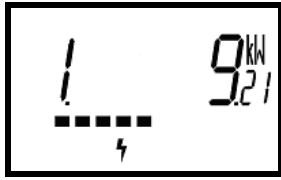
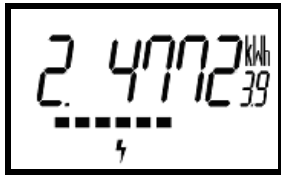
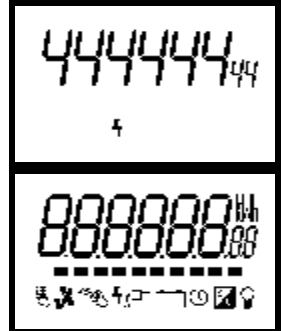
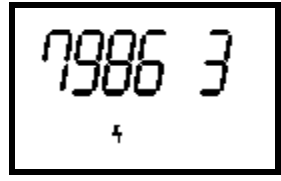
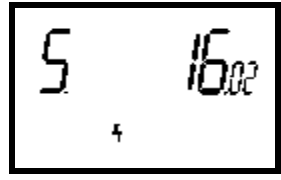
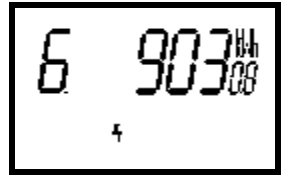
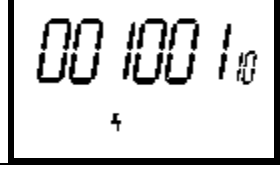
Cause of last suspension of electricity supply


Should the consumer's supply be suspended the reason for the disconnection will be visible on the display. The possible reasons for suspension of supply are:

Reason for suspension	Example	
Credit expiry	<p>The "enter token" icon  will no longer flash but remain on.</p> <p>The "supply status" icon  will remain off.</p>	
Power overload	<p>The bar graph will be flashing constantly, indicating an overload condition.</p> <p>The "supply status" icon  will remain off.</p>	
Power unbalance	The power unbalance display will be the same as that of the power overload.	
Tamper detection	<p>There are four configurable options:</p> <ul style="list-style-type: none"> • Do not display the tamper status and do not suspend the consumer's supply • Do not display the tamper status but suspend the consumer's supply • Display the tamper status but do not suspend the consumer's supply • Display the tamper status and suspend the consumer's supply. • The graphic on the right indicates that a tamper condition has been detected and the consumer's supply has been suspended. 	

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#	<p>Average Power in kW The amount of electrical power in kW's currently being used averaged over a 15 second period will be displayed for 10 seconds before reverting to the normal credit display. The example shows consumption of 9.21 kWh</p> 
#2#	<p>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</p> 
#3#	<p>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.</p> <p>Type #3## and the segment display test will be invoked. Once the test is complete it will revert to the normal credit display.</p> 
#4#	<p>Meter Serial Number The MCU serial number will be displayed. After 10 seconds it will revert to the normal credit display. The serial number is scrolled in from right to left. The example shown indicates an MCU serial number ending in "7986" with a Luhn check digit of 3.</p> 
#5#	<p>UIU Software Version The software version number of the UIU will be displayed. After 10 seconds it will revert to the normal credit display. The example indicates a UIU software version of 16.02.</p> 
#6#	<p>Total User Credit Entered 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</p> 
#7#	<p>Display Meter Status The meter status register is displayed in bit form. After 10 seconds the display will revert to the normal credit display.</p> 

# 1 0 #	<p>Display Supply Group Code (SGC) 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>	
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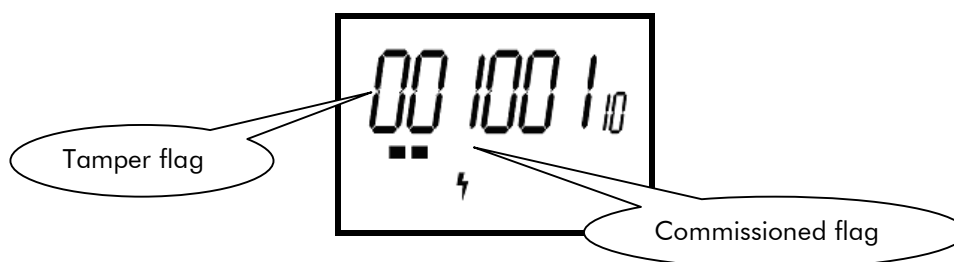
Meter Status Register

Type **# 7 #** 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	Reserved for Internal Use	
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 2: 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, (0), the meter has not detected a tamper condition. When set, (1), 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 terminal cover is removed. If the flag is cleared (0) the consumers' supply will be disconnected and the tamper detection functionality within the meter will be disabled.

Section 8 : Engineering Tokens

Maximum Load Limit token (Meter Specific)

This token is used to adjust the maximum power limit of the meter and is issued by the vending unit. The three phases of the BEC33HC may be set from 575 W to 23 kW. (At unity power factor, this would equate to a programmable range between 2.5A and 100A). This token may only be used once.

Note: The load limit is measured in kW and is the maximum load limit per phase, not the cumulative value.

Clear Credit token (Meter Specific)

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

Key Change token (Meter Specific)

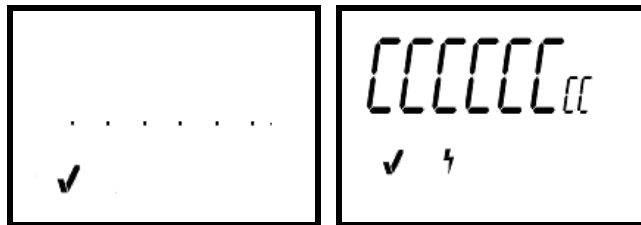
This token is used to replace the existing key with a new one i.e. when changing the Supply Group Code, Tariff Index or Key revision. It is a 40-digit number for the keypad meter.

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.


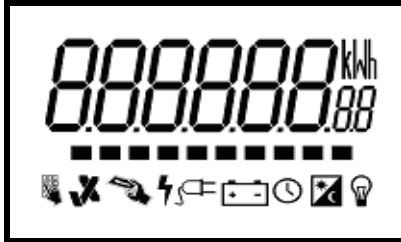
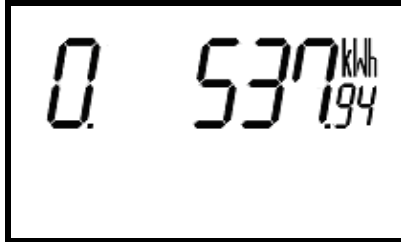
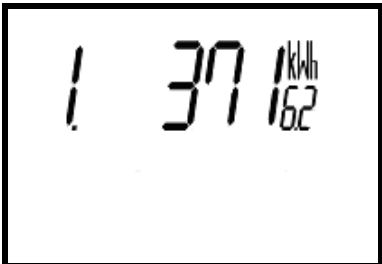
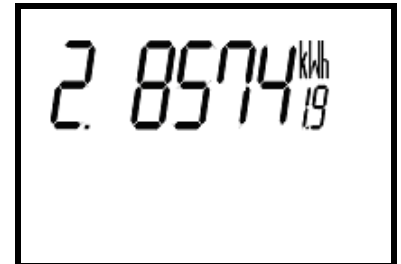
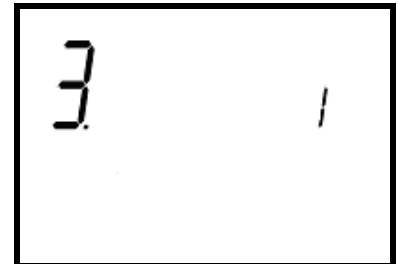
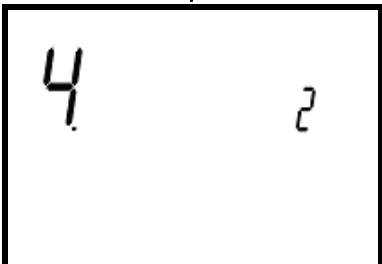
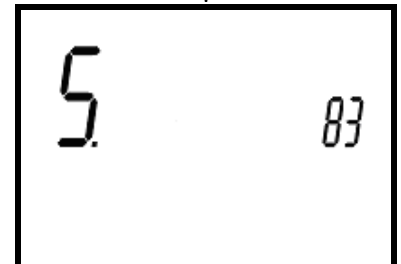
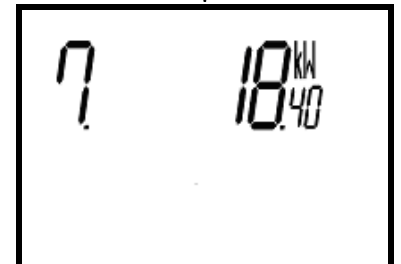
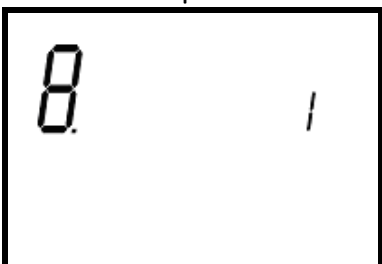
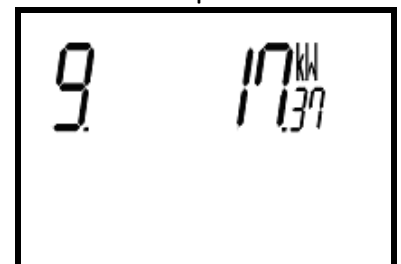
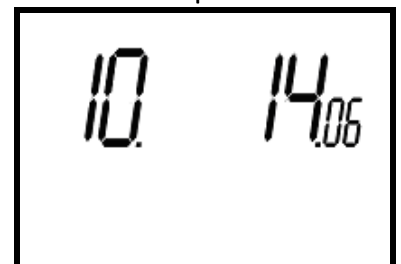
Meter Test token (Non-Meter Specific)

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.**

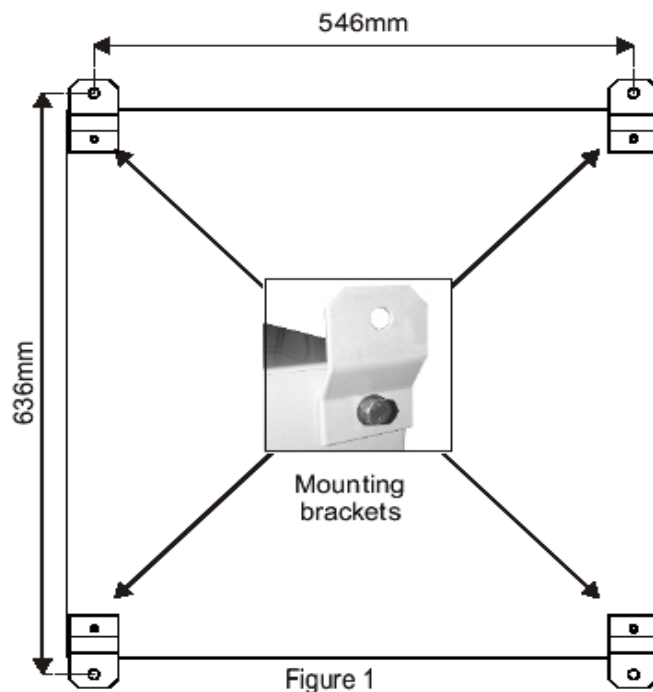
<p style="text-align: center;">Step 1</p>  <p>Open contactor / trip breaker if there is credit in the meter</p>	<p style="text-align: center;">Step 2</p>  <p>Perform LCD display test. Perform optical dump via rate LED</p>	<p style="text-align: center;">Step 3</p>  <p>Positive credit – disconnection device opens and closes Negative Credit – disconnection device is not activated</p>
<p style="text-align: center;">Step 4</p>  <p>User Total Consumption To Date.</p>	<p style="text-align: center;">Step 5</p>  <p>Meter Total Consumption To Date.</p>	<p style="text-align: center;">Step 6</p>  <p>Key Revision Number.</p>
<p style="text-align: center;">Step 7</p>  <p>Key Type.</p>	<p style="text-align: center;">Step 8</p>  <p>Tariff Index.</p>	<p style="text-align: center;">Step 9</p>  <p>Load limit. The power in Watts</p>
<p style="text-align: center;">Step 10</p>  <p>Tamper Status 00 – Meter not in tamper mode 01 – Meter in tamper mode</p>	<p style="text-align: center;">Step 11</p>  <p>Average Power Consumption.</p>	<p style="text-align: center;">Step 12</p>  <p>Meter Software Revision Number. If positive credit the disconnection device will open and close again.</p>

Section 9 : Installation of the meter

Installing the MCU on the Wall

1. Determine the cable entry point and meter position (between 1.3m and 1.5m above the floor level).
2. The mounting brackets with bolts and washers will be packaged in bubble wrap and attached to the pilot holes at the bottom of the meter enclosure.
3. Fasten and secure the mounting brackets to the back of the meter enclosure with the $\text{Ø}6\text{mm}$ bolts and washers supplied, as shown in Figure 1.
4. Mark and drill the four holes in the wall, not closer than 1m from the nearest tap or water pipe.
5. Mount the meter on the wall using $\text{Ø}8\text{mm}$ rawl bolts.
6. Tighten all four rawl bolts.
7. Glands should be fitted to the $\text{Ø}8\text{mm}$ pilot holes provided at the bottom of the meter panel enclosure.
8. Fit three glands for the Line feed, Load feed and Comms cable respectively.

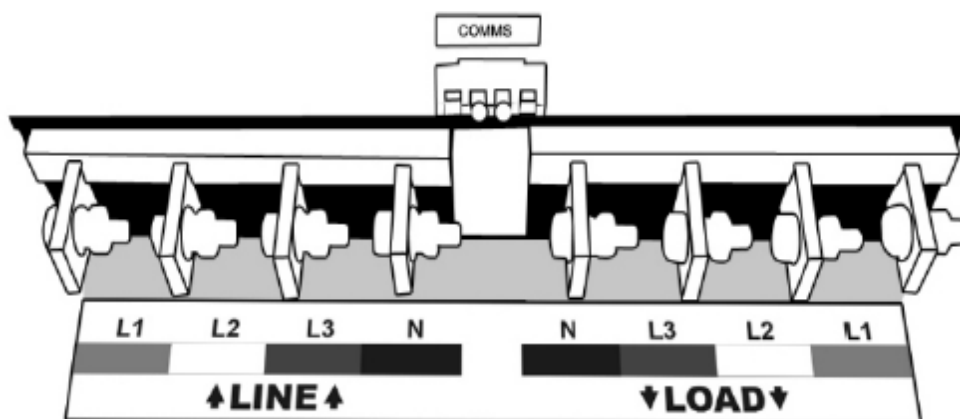
Note: This product requires the use of upstream and downstream breakers. These devices are not to be placed within the meter housing.



Wiring up the MCU

CAUTION: THE WIRING IS TO BE PERFORMED BY A CERTIFIED INSTALLATION ELECTRICIAN AND MUST CONFORM TO THE PREVAILING GOVERNMENT STANDARDS AND SAFETY REGULATIONS.

1. Make sure the incoming power is isolated, by switching off the upstream breaker.
2. Line cable to be fed through the gland on the left-hand side.
3. Communication cable to be fed through the center gland.
4. Load cable to be fed through the gland on the right-hand side.
5. When connecting to the busbars of the meter use $\text{Ø}10\text{mm}$ nuts, bolts, washers, and spring washers that are supplied. (Fitted to each busbar).
6. Connect incoming **BLACK** (neutral) to "LINE N".
7. Connect incoming **RED** phase (line 1) to "LINE L1".
8. Connect incoming **WHITE** phase (line 2) to "LINE L2".
9. Connect incoming **BLUE** phase (line 3) to "LINE L3".
10. Connect outgoing **BLACK** (neutral) to "LOAD N".
11. Connect outgoing **RED** phase (line 1) to "LOAD L1".
12. Connect outgoing **WHITE** phase (line 2) to "LOAD L2".
13. Connect outgoing **BLUE** phase (line 3) to "LOAD L3".
14. Connect the communication cable to terminals marked "COMMS" between the **LINE N** terminal side and **LOAD N** terminal. Note the communications cable is not polarity sensitive.
15. Connect the **EARTH** to the chassis of the box according to the local requirements.
16. Check that all terminal block bolts are tight.



REMEMBER TO USE BI-METAL LUGS IF YOU ARE CONNECTING ALUMINIUM CABLES TO THIS PRODUCT.

Warning: Aluminium cables may only be used if connected with suitable 'Copper Aluminium Bi-metallic lugs'. Below are some examples of what a Copper Aluminium Bi-metallic Terminal / Lug looks like.

Recommended Cable and Sizes

PVC insulated cable requirements for 250A

Recommended cable size (according to SABS 0142-1)

Based on: Ambient temperature 30 °C

Conductor operating temperature 70°C

Cable Specification	Copper	Aluminium
Single core PVC insulated unarmoured cable. 3 or 4 cables, 3phase, enclosed in conduit on a wall or in trunking.	150mm ²	240mm ²
Multicore core PVC insulated unarmoured cable. One 3-core or one 4-core cable, 3phase, enclosed in conduit on a wall or in trunking.	185mm ²	300mm ²
Single core PVC insulated unarmoured cable. 3 or 4 cables, 3phase, on a perforated cable tray or in free air.	95mm ²	185mm ²
Multicore core PVC insulated unarmoured cable. One 3-core or one 4-core cable, 3phase, on a perforated cable tray or in free air.	120 mm ²	185mm ²
Multicore core PVC insulated armoured cable. One 3-core or one 4-core cable, 3phase, on a perforated cable tray or in free air or buried directly	95 mm ²	185mm ²
Multicore core PVC insulated armoured cable. One 3-core or one 4-core cable, 3phase In pipes or ducts buried in the ground	150mm ²	240mm ²

Current Rating

The current rating of the meter will be determined by three factors:

- The size of the incoming line and outgoing load conductors used to wire the meter
- The ambient temperature
- The ventilation around the cabling and the enclosure

Assuming the entry and exit cables are exposed to free air for at least 1m outside the meter box (in other words not enclosed in conduit etc) and the meter box is mounted in a well-ventilated area; the following table shows the expected maximum continuous rating of the meter.

Copper Cables

Line & load cables [Cu]	Ambient Temperature							
	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C
95mm ²	275A	263A	250A	237A	225A	212A	200A	187A
120mm ²	280A	275A	263A	250A	237A	225A	212A	200A
150mm ²	280A	280A	275A	263AA	250A	237A	225A	212A
185mm ²	280A	280A	280A	275A	263A	250A	237A	225A

Aluminium Cables

Line & load cables [Al]	Ambient Temperature							
	20°C	25°C	30°C	35°C	40°C	45°C	50°C	55°C
150mm ²	275A	263A	250A	237A	225A	212A	200A	187A
185mm ²	280A	275A	263	250A	237A	225A	212A	200A
240mm ²	280A	280A	275	263A	250A	237A	225A	212A
300mm ²	280A	280A	280A	275A	263A	250A	237A	225A



Installing the UIU

NOTE: THE BEC33HC METER CAN ONLY BE USED IN CONJUNCTION WITH A GENERIC 70P UIU. SOFTWARE VERSION – 16.08 OR HIGHER. TO CHECK THE SOFTWARE VERSION OF THE UIU PRESS **#5#**

1. Determine the cable entry point and UIU position (between 1.3m and 1.5m above floor level).
 2. Position the base on the wall and mark the holes, as shown in Figure 2, not closer than 1 meter from the nearest tap and not directly above a stove.
 3. Drill the holes in the wall with a Ø6mm masonry bit deep enough to accommodate the wall plugs.
 4. Insert the wall plugs into the drilled mounting holes.
 5. Position and align the UIU base with the drilled holes.
 6. Screw the UIU base onto the wall and bring the communication cables in through the pre-drilled hole.
 7. Tighten all screws on the base making sure that the base is not distorted or twisted.
 8. Connect the communication cables to the back of the UIU, by inserting a 3.5mm screwdriver into the communication connector (thereby opening the terminal contacts). Insert the communications cable into the connector opening, and then remove the screwdriver. Refer to Figure 2.
- Note:** these cables are not polarity sensitive.
9. Curl up the cable slack behind the UIU making sure that it does not get damaged when the UIU is secured to the base.
 10. Secure the UIU to the base with the two screws provided.
 11. Insert the security seals.

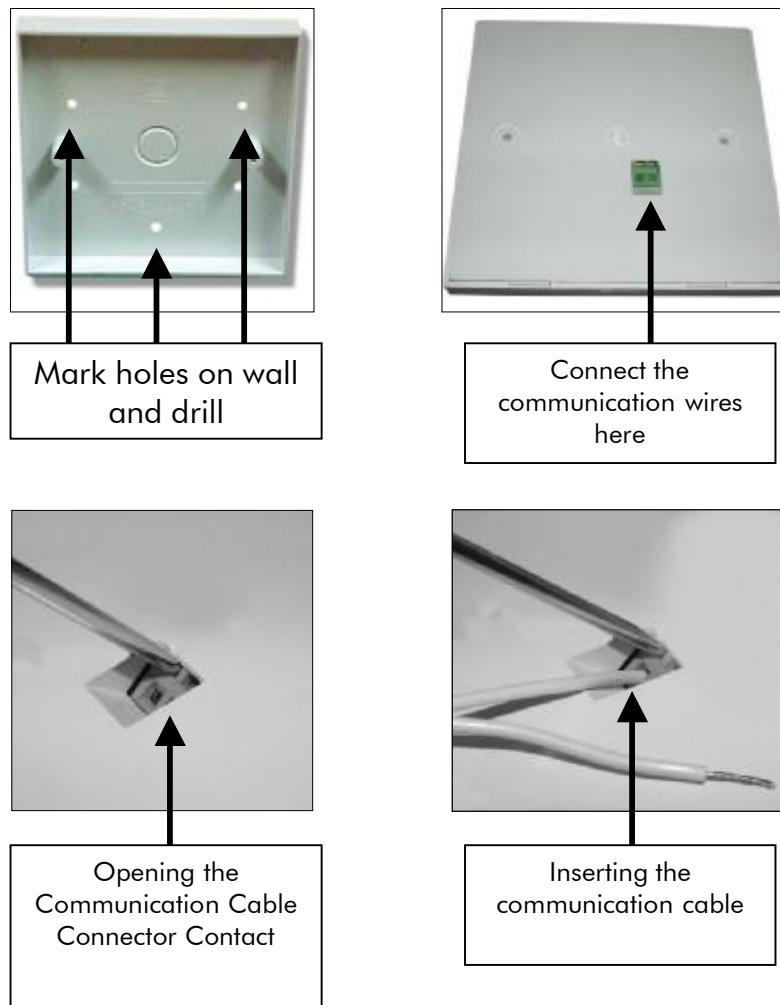


Figure 2

Testing the meter installation and sealing the unit

1. Record the MCU serial number from the label on the inside of the housing.
2. Close the front door of the meter panel and secure the door lock handle as illustrated in **Figure 3**.
3. Apply AC power to the meter by closing the upstream breaker.
4. Ensure that the UIU is correctly wired; the LCD should display the remaining credit.
5. If the meter is configured to detect a tamper condition and has not been commissioned at the time of manufacture, a commissioning token is required. The commissioning token connects the consumer's supply to the line and enables the tamper detection feature.
6. The commissioning token is: **1275 4194 1448 6450 5970**
7. Make sure the consumer's supply is connected by switching on a load (an appliance or light). After a while the rate LED should start pulsing.
8. Perform the STS 0 meter test on the UIU, refer to 'Test Token' in Section 8.
9. Once the UIU reverts to the default credit display, press **⏏ 4 ⏏** to display and record the MCU serial number.
10. Ensure that this number corresponds with the serial number on the MCU recorded in step 1 and the meter identification card before handing over to the customer.
11. Explain the meter functionality to the consumer and leave the UIU operating instruction pamphlet with the consumer. Mark the appropriate meter type installed on the UIU operating instruction pamphlet.
12. Complete documentation relating to the customer.
13. To seal the meter, secure the handle of the panel enclosure with a suitable padlock. The consumer must not have access into the meter panel enclosure, for safety and security reasons.



Figure 3


Removing the MCU

1. Isolate the incoming power by opening the upstream breaker.
2. Unlock the padlock and open the meter box door.
3. Remove all the cabling; mark the cables if necessary, so that you know which cable is the Line Side, which cable is the Load Side and which cable is the communication cable.
4. Unscrew the bolts holding the meter on the wall.

Note: If you have not isolated the incoming supply then opening the front door will induce a tamper condition. You will have to clear the tamper with a Clear Tamper Token.

Section 10 : Using a BEC33HC Electricity Meter

STEP 1

Before consuming electricity, credit must be purchased from the nearest electricity sales point. If the meter ID card is not available the meter serial number can be extracted by entering the special function command, . This number is to be written down and taken to the sales point.


Important:


The token can only be used for the nominated meter.

The token can only be entered into the meter once.


Token Expiry: Conlog meters embody a token expiry system, which employs a record of the last 50-meter specific tokens entered. Each token has its date and time recorded. Should the 51st token be older than the oldest token it will be rejected as an old token. It is recommended that purchased tokens are entered into the meter within three months of purchase.

STEP 2

The 20-digit credit 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 token.

STEP 3


After entering the 20-digit token, the meter will check the validity. If the number is valid the display will flash the amount of credit purchased for a short time and the "tick" icon  will appear. The disconnection switch will then automatically connect the electricity supply. After a few seconds the total remaining credit will be displayed.

STEP 4

When switching on lights or any appliances, the red rate LED below the  label will begin to flash.

The more appliances that are 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

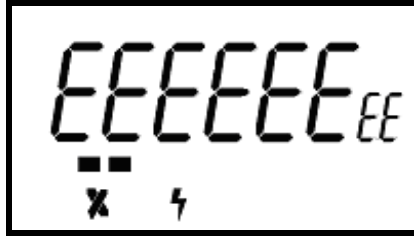
When the credit level starts running low (below 25.5kWh), the "enter token" icon, , on the display will start flashing. This is a warning that another credit token must be purchased. If the dispenser runs out of credit, the disconnection switch will trip and suspend the electricity supply. To reconnect the electricity supply, a credit token must be purchased and the 20-digit token keyed into the dispenser.

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 **x** 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 **x** 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 device. 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 disconnects the load 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  flashing if configured for this type of display. Type #7# to see what bit 7 is, if it is a '1' then the meter is in tamper. 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

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, during the running of the test, it removes power from the internal electronics of the meter thus the meter shut down. Remove the meter and correct the wiring.

Question When putting a meter in the wall base there is no power on the meter. The up stream 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 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.

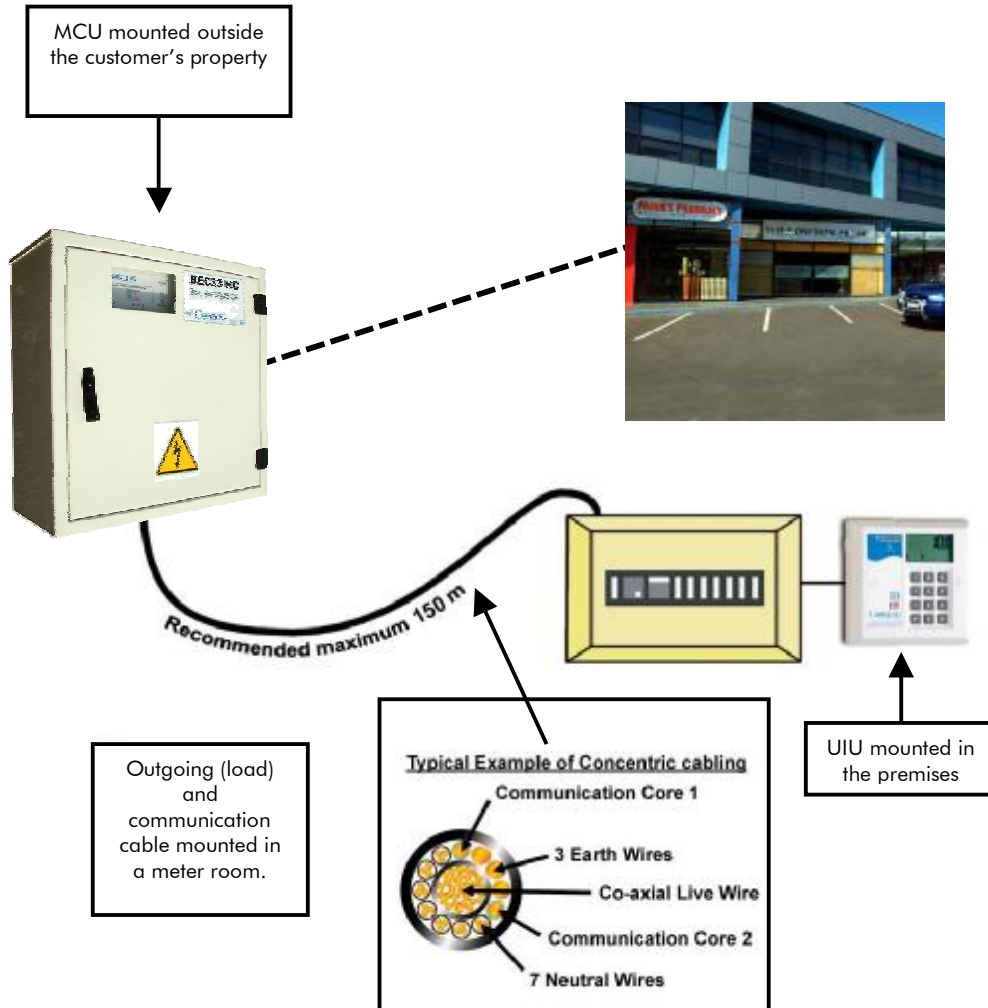
Error Codes on Meters

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
E	01	Send meter back to Conlog
E	02	Send meter back to Conlog
E	03	Send meter back to Conlog
E	04	Send meter back to Conlog
E	05	Send meter back to Conlog
E	06	Send meter back to Conlog
E	07	Check communications cable

Section 12 : Typical Installation

As can be seen from the diagram below, the MCU is mounted in the meter room inside the customer's premises with the outgoing and communication cables running to the distribution board mounted inside the business premises. The communication cable is then extended out of the distribution box via a piece of conduit to the UIU.



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.
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: <ul style="list-style-type: none"> • 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 / Switch
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	Pre-Payment Meter. 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.
Relay	See Latch
S SM	See Security Module
SGC	See Supply Group Code
STS	Standard Transfer Specification , which defines the standard token coding method and format.
STS Token	Tokens that are made to work in meters that use the STS algorithm. 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 arrester.
	Wire Seals	See Lead Seal or Security Seal

Section 14 : Technical Specifications

Voltage Range	220-240VAC (phase voltage) -20% + 15% 380-415VAC (line voltage) -20% + 15% 110-127VAC (available on request)
Supply Frequency	50 Hz \pm 2% 60 Hz \pm 2% (available on request)
Current Ratings	Maximum current (I _{max}) 250 A per phase at 30°C Maximum current (I _{max}) 227 A per phase at 55°C Base current (I _b) 30 A Starting current (0,005 I _b) 0,15 A
Supply Burden	Nominally 2.5W & 18VA (per phase)
Disconnection	Three 250 Amp bi-stable load switches
Accuracy	Class 2
Over Voltage Rating	420VAC (phase voltage) for up to 48 hours
Short Circuit Rating	Short-circuit current 7.5kA
Environmental Specification	Operating Temperature: -10°C to +55°C Storage Temperature: -25°C to +70°C Humidity: 95% non-condensing IP Rating: IP54 – MCU IP Rating: IP51 – UIU
Customer Displayed Information	User consumption details Status of incoming supply Available credit and low credit warning Consumer supply status Token accept / reject Consumption rate LED Tamper status Power overload Graphic display of average power
Encryption 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
Installation – MCU	Intelligent commissioning Asymmetrical Footprint Wall mounted Secured by 4 Ø8mm rawl bolts
Functional Product Components	Electricity measurement circuit Consumer electricity supply disconnect LCD consumer display interface Lightning protection
Other Functions	Optical data reader on UIU Flags probe port
User Interface Unit	Current loop noise immune communications Standard 4x4 wall socket footprint
Standards	IEC 62052-11 IEC 62053-21 IEC 62055-41 IEC 62056-21 ISO 14001:2004 ISO 9001:2000 ESKOM TRMSCAAP2

Section 15 : Contact Information

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