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# CALMU3+

## INSTALLATION AND OPERATING INSTRUCTIONS

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### **IMPORTANT SAFETY INFORMATION**

Care must be exercised during the installation of CALMU3+ meters and associated equipment due to the presence of mains voltages.

Local best practice and regulatory stipulations must always be observed.

Installation should only be performed by suitably trained personnel. Various points under the terminal cover operate at hazardous voltages.

There are no user-serviceable or installer-serviceable parts inside. Removing the cover with power applied exposes potentially hazardous voltages.

Each CALMU3+ must be protected by fuses or voltage isolating links in each voltage circuit. CT shorting links should also be fitted.

Under no circumstances should the CT connections to the meter be disconnected while current is flowing in the primary circuit of the external CT.

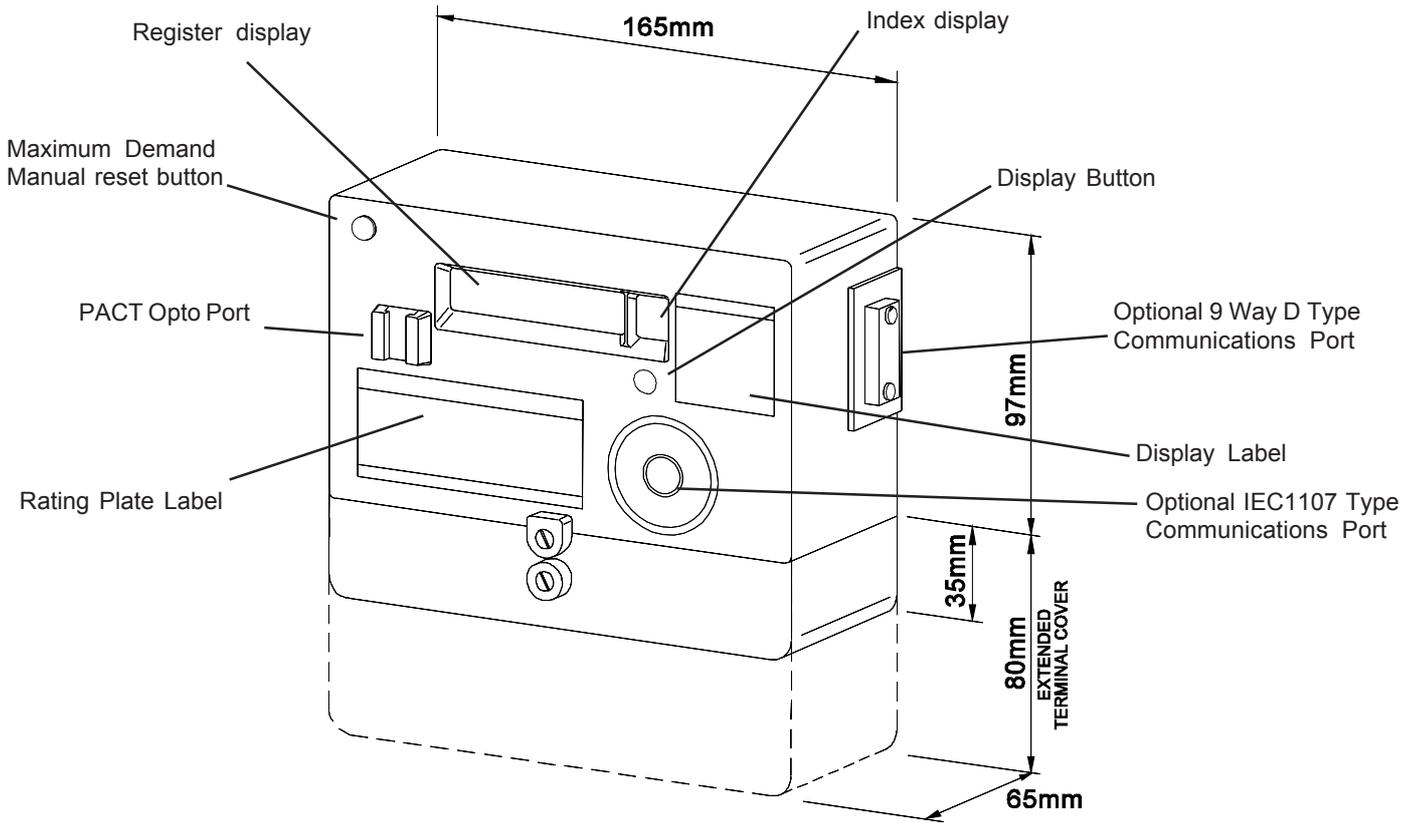
After installation access to the connectors and conductors must be prevented by fitting the covers supplied, ensuring that they are secured in position with the screws provided and sealed in accordance with local practice.

Suitable cabling must be used if mains voltages are to be connected to the input or output terminals. Double insulated cabling of at least 1mm<sup>2</sup> must be used.

#### **CE MARKING DECLARATION OF CONFORMITY**

CALMU3+ meets standard BS EN 610336:1997, and therefore conforms to EU Directive 89/336/EEC 'EMC Directive' as amended by 92/31/EEC and 93/68/EEC.

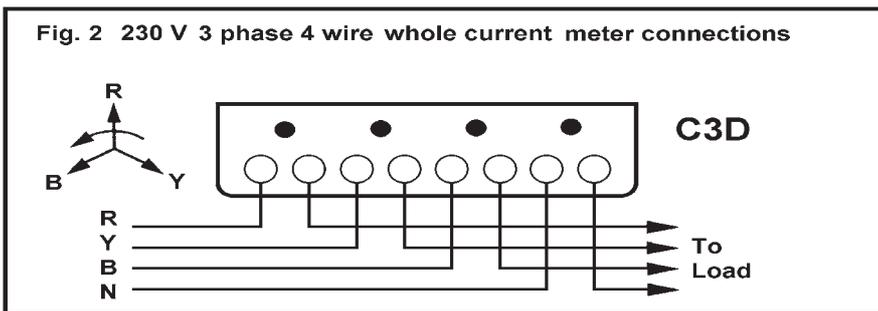
**SECTION A: MAIN FEATURES AND DIMENSIONS**



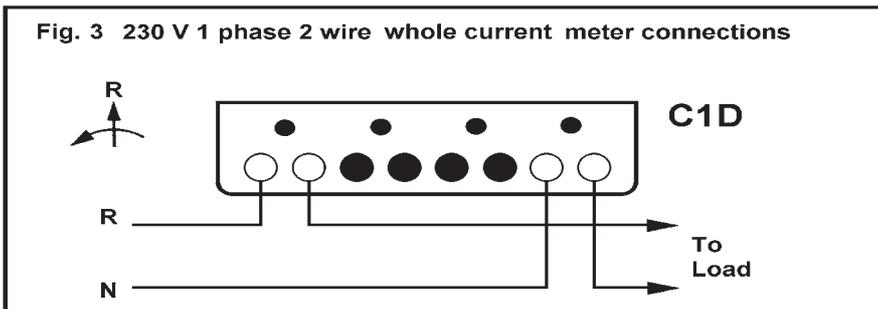
**Fig. 1 CALMU3+ External Features and Dimensions**

**SECTION B: ELECTRICAL CONNECTIONS AND WIRING CONFIGURATIONS**

Five CALMU3+ wiring variants exist to cater for the most commonly encountered wiring configurations. Check that the meter supplied is suitable for the installation before making any connections. Note that as CALMU3+ is an OGFEM approved billing meter there is no variant for connection to low voltage supplies that do not have a neutral connection.

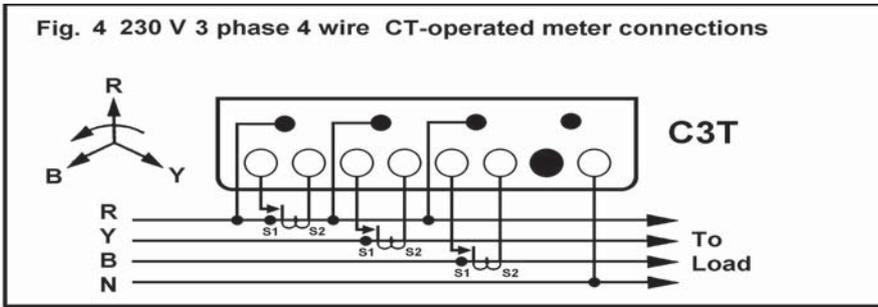


Whole current (direct connected) meters are suitable for connection to supplies of up to 100 A.



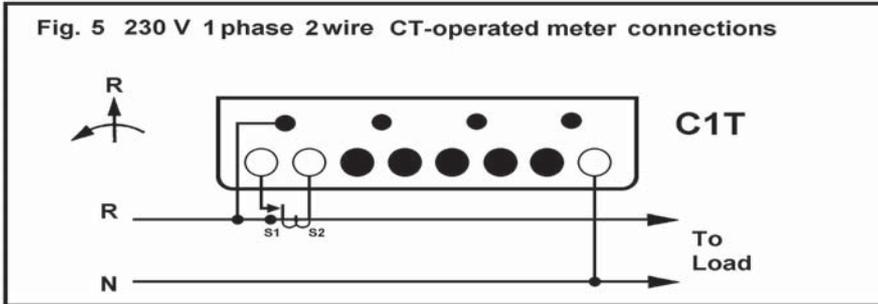
Whole current meters can be supplied with blanking plugs fitted in unused conductor bores.

Any of the phases can be connected; it does not have to be the red phase.



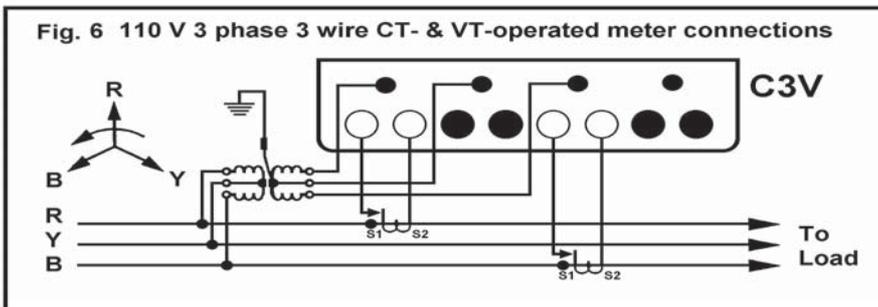
CT-operated meters are supplied in two versions; one for use with external CTs with 1 A output and one for use with CTs with 5 A outputs.

Note: External CTs must be fitted with P1 toward the supply. It is acceptable to common together the secondary (S2) connections from the external CTs and connect them to ground.



CT-operated meters can be supplied with blanking plugs fitted in unused conductor bores.

Any of the phases can be connected; it does not have to be the red phase.



**Special Note:** For 3-Phase 3-Wire balanced installations correct operation can be achieved with only one voltage transformer.

Refer to supplier for details.

## SECTION C: INSTALLATION

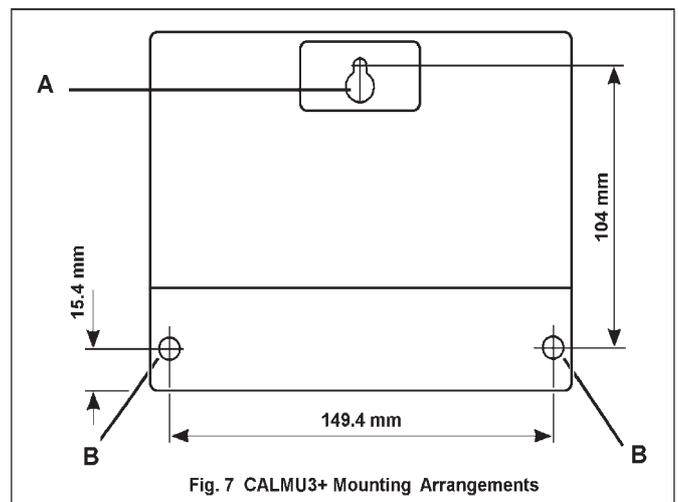
### How to fix the meter in position

CALMU3+ meters are designed for vertical mounting, and can be fitted to meter panels, boards, enclosures or walls. Suitable screws must be selected to ensure a good fixture. Screws of up to M4 or 4BA size can be used.

CALMU3+ meters use a three-point fixing arrangement. The top screw is located on the meter's centre-line and fits into a 'key-hole' locator on the rear-plate of the meter. This screw supports the meter in position on the surface to which it is attached. Two other screws are fitted through the terminal block of the meter and are used to secure it against the mounting surface.

The fixing centres are as shown on this view of a CALMU3+ rear panel.

1. Mark out the position of the meter on the mounting surface, drill a hole and fit the top fixing screw (A).
2. Fit the CALMU3+ over the top fixing screw taking care to align it correctly within the 'key-hole' locator.
3. With the terminal cover removed, mark out the positions of the lower fixing screws (B).
4. Remove the meter, drill holes for the lower fixing screws.
5. Fit the meter over the top fixing screw again.
6. Fit the lower fixing screws



**Note:**

Sufficient space must be provided on all sides of the meter when the fixing centres are marked out. Overall height of the CALMU3+ is 177 mm with extended terminal cover fitted, 132 mm with standard cover. Overall width of the meter is 165 mm, but models fitted with a 'D' port require at least 75 mm extra clearance on the right hand side.

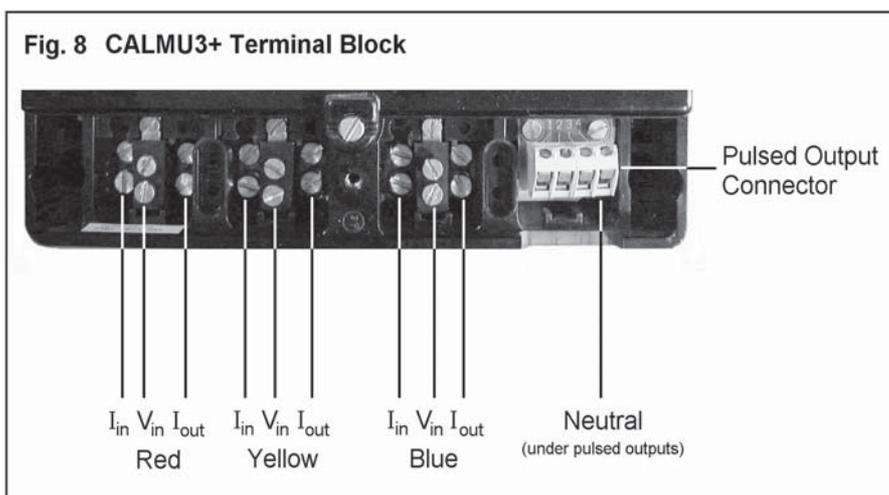
## SECTION D: FITTING CONDUCTORS

Local best practice must be observed when selecting conductor size and type.

All CALMU3+ models can accept cabling from 2.5 - 5.0 mm<sup>2</sup> conductor area for voltage connections, and up to 65 mm<sup>2</sup> for current connections. CT-operated CALMU3+ meters are supplied with an extended terminal cover, and are intended to be used in installations in which all the cabling is concealed; it is not therefore necessary to use double-insulated cable. Direct-connected (whole-current) CALMU3+ meters are supplied with a standard terminal cover to allow thicker cables to enter the terminal block directly. The cables must be cut and trimmed carefully. The insulation must be cut back and removed 'squarely', ensuring that no copper is exposed on the portion of the cable outside the conductor bore. Particular care must be taken to ensure that all the conductor strands are contained within the conductor bore. Approximately 20 mm of conductor should be cut back when the cable is trimmed.

The process for fitting the conductors is as follows:

1. Cut and trim the cables
2. Loosen the conductor screws
3. Insert the cables fully into the conductor bores, ensuring no copper is left exposed
4. Tighten the conductor screws
5. Refit the terminal cover
6. Seal the terminal cover



## SECTION E: CONNECTING OUTPUTS TO EXTERNAL DEVICES

CALMU3+ meters can be supplied with up to three pulsed outputs configured, for connection to external devices. The outputs are controlled by a combination of the CLEM operating program and the tariff configuration file loaded into the meter.

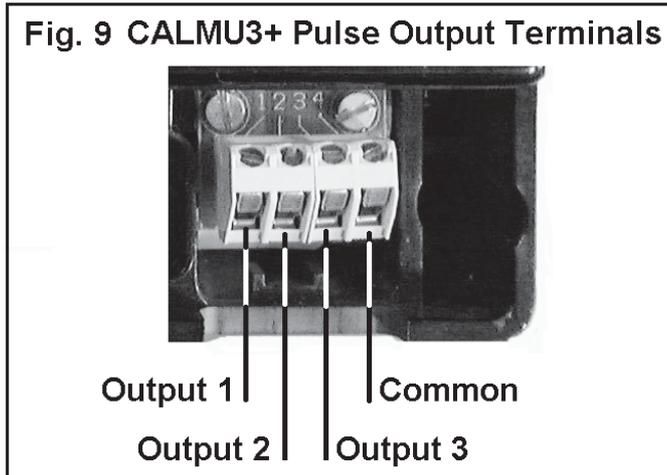
The outputs are accessed under the terminal cover and the terminal block can accept cable sizes of up to 2.5 mm<sup>2</sup>. The contacts are arranged in a four-way terminal block, with the rightmost terminal, '4', being the common connection. The remaining contacts, '1', '2' and '3', are the outputs 1, 2, and 3.

Pulsed outputs are volt-free relays with contacts rated for connection to voltages up to 240 V ac or 350 V dc, and can switch up to 2 A (50 VA) into a non-inductive load. The minimum pulse width for output pulses is 80 ms. The maximum theoretical pulse frequency is typically 1 Hz, but this is not attainable for some primary scaled values.

The output contacts for the relays inside the CALMU3+ are connected between the appropriate pin and the common connection. Pulses from output 1 therefore appear between pin 1 and pin 4, for example.

The assignment of the pulsed outputs is determined by the tariff file loaded at manufacture. The standard options available are detailed in the adjacent table. The value of energy pulses is determined by the meter scaling, see section J for details.

*Note: Refer to supplier for details of pulsed output options.*



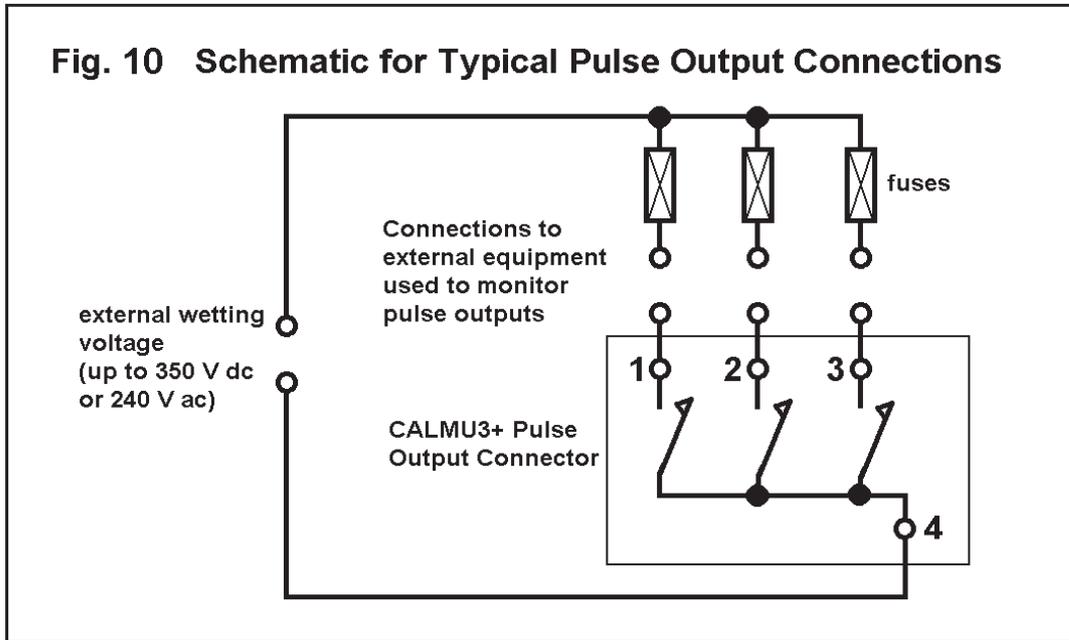
**Table 1 Tariff Pulse Output Options**

Model	Tariff	LHR	Response Profile CoP5	Tariff+
Output 1	kWh	kWh	kWh	kWh
Output 2		kVAh	kVAh	kVAh
Output 3			MD Synch.	kvarh

The pulsed outputs can be used to switch small external loads (no more than a few milliamps) directly, but significant or inductive loads should be switched via an interposing (barrier) relay.

The fitting of a small inline fuse (of a few milliamps capacity) is recommended for most installations. It is permissible to fit load-limiting resistors and snubbing components (a small capacitor across the contacts) according to local best practice.

Figure 10 shows typical pulse output connections for use with external sensing equipment with high-impedance inputs.



## SECTION F: COMMUNICATIONS

All CALMU3+ meters are equipped with a PACT optical port for communications with external devices. A second communication port, either a 'D' port or an '1107' port, can be fitted at manufacture. It is not possible to fit both options. All communications ports communicate at 1200 bd and can be used for retrieval of meter readings (energy and demand) and also for interrogation of instantaneous electrical parameters such as current, voltage and power. CALMU3+ is fully compatible with PRI's DOS-based Principal software and Windows-based EASEii package.

The PACT port is a slot fitted on the meter front panel to the left of the LED display. PACT probes can be connected for local communications with a laptop PC, or remotely over PSTN via an external modem.

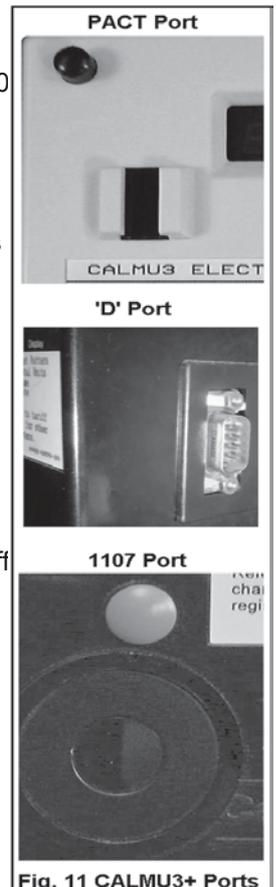
The optional 9-pin 'D' port is fitted on the right hand side of the meter and is intended for permanent connection to a PC, modem or PACTLAN network system

The optional '1107' port is a circular device mounted on the front panel of the meter and is intended for local communications with hand-held units.

All the ports can be used to retrieve load survey data stored by some CALMU3+ meters. The tariff file loaded at manufacture determines how load survey storage is set up. The table below shows the parameters and the number of days stored for each of the standard configurations. Note that the option 'Tariff' does not support load survey.

**Table 2. Tariff Load Survey Options**

Programming Options	LHR (Heathrow) Profile Single Response Tariff+	Profile CoP5
Number of Days	160	53
Parameter 1	kWh	kWh
Parameter 2	N/A	kVAh
Parameter 3	N/A	kvarh



**Fig. 11 CALMU3+ Ports**

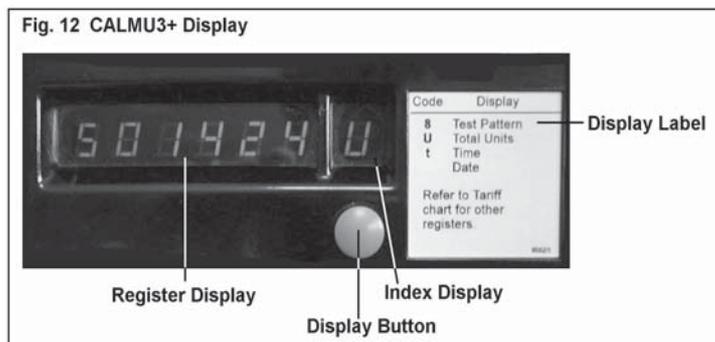
## SECTION G: DISPLAY OPERATION

CALMU3+ meters are equipped with an LED window for displaying metering and status information.

The display is operated using the push button mounted on the front panel, each press advances the display by one position in the 'display sequence' programmed at manufacture.

A special feature of the display is the decimal point in the extreme right-hand (index) position. This flashes at a rate proportional to the instantaneous active consumed power. This can be useful when commissioning a meter; if the decimal point is not flashing it shows that the meter is not seeing consuming active power, which could indicate that the CTs are connected in reverse.

The exact configuration of the display is determined by the combination of CLEM program and tariff file loaded into the meter at manufacture. Note that 'time-of-use' tariff rate registers, such as 'day' and 'night', are only displayed if implemented in the tariff loaded into the meter at manufacture. The default tariffs for each programming option do not include time-of-use tariff files, therefore the only rate register normally displayed is 'rate 0', unless a particular tariff arrangement was specified at time of ordering.



Note that the 'Heathrow' specification includes two time-of-use registers; 'Rate 1' from midnight to 7 am and 'Rate 2' from 7am to midnight.

This document covers the 'standard' configurations available from PRI.

*Refer to supplier for details of programming configurations.*

## SECTION H: DISPLAY OPTIONS IN TARIFF

The table below shows the display sequence for the most common programming options for CALMU3+. The display button is used to step through the list of available displays. The first press of the display button brings up the test pattern. The display is automatically turned off after about 30 seconds (to maximise the life of the LEDs) unless the button is pressed again.

**Table 3. Tariff Display Options**

Display Number	Tariff (TPA1+STANDARD)	Tariff+ (TPA1+TPPROF00)	Heathrow (TPA1+LHR00001)	Profile CoP5 (C5D3+COP50000)
	Profile Single (C5D1+COP5000)	Response (TRA1+RESPLUS0)		
	Coningsby (TPA1+CONINGSBY)			
1	Test Pattern	Test Pattern	Test Pattern	Test Pattern
2	Total kWh	Total kWh	Total kWh	Total kWh
3	Time	Total kVAh	Total kvarh	Total kVAh
4	Date	Total kvarh	Total kVAh	Total kvarh
5	Rate Regs.	Power Factor	Time	Power Factor
6		KVA MD	Date	KVA MD Header
7		Time	Power Factor	KVA MD
8		Date	KVA MD	Time
9		Rate Regs.	MD Reset Count	Date
10			Rate 1 (Night)	Rate Regs.
11			Rate 2 (Day)	

All CALMU3+ meters can be set up with time-of-use (STOD) rate registers, with the exception of the Heathrow (LHR) programming option which has a fixed two-rate tariff.

If a STOD tariff has been set up at manufacture the rate registers appear at the end of the display list as indicated in the table above.

All the programming options that include an MD register are set up to perform an automatic self-billing operation at the start of each month. As part of this process the MD register is reset to zero. The total energy and tariff rate registers are never reset, and continue to accumulate up to 999999 units, at which point they roll-over to 000000. The MD reset button, where fitted, can be used to reset the MD in between self-billing operations, subject to a maximum of one reset per day.

## SECTION I: DISPLAY FORMATS

CALMU3+ meters have a seven-digit LED display, each digit having seven segments. The display is divided into two parts. The main part of the display has six digits and is used to display register contents. The single digit in the smaller part of the display is used as an 'index' to identify the contents of the register being displayed on the main part of the display.

The following display formats are used on CALMU3+. Note that not all the displays listed will appear on any particular CALMU3+. Refer to the Display Options chart in Section H.



Test pattern. All segments illuminated.



Total unit register for active energy (imported kWh). The meter factor (or units multiplier) printed on the display label indicates the multiplier to be applied to the contents of the registers (e.g. x10, x100).



Total unit register for apparent energy (kVAh), in this case showing 92874.



Total unit register for reactive energy (lagging for imported kWh), in this case showing 1289.



Power factor. This shows the average instantaneous power factor across the connected phases. This display is updated approximately every second. A minus sign indicates leading power factor.



kVA MD for the current month. The meter factor (or units multiplier) printed on the display label indicates the multiplier to be applied to the contents of the registers (e.g. x10, x100). The MD is reset automatically at the end of each month, or by pressing the reset button.



Time, shown in 24-hour format, hh.mm.ss. CALMU3+ meters are set to standard time (GMT) at manufacture. No adjustment is made for summer time (BST).



Date, shown in dd.mm.yy format.



Rate register for time-of-use register 1. The register switching times are determined by the tariff file loaded at manufacture. Rate registers are only displayed if they have been set up at manufacture.



Rate register for time-of-use register 2. Each register is identified by a number in the index position of the display.

## SECTION J: METER SCALING

CALMU3+ meters are configured at manufacture to suit the intended application. This includes programming arrangements for tariff as well for meter scaling. CALMU3+ meters are usually supplied with 'primary scaling' so that the metering values reported are scaled up to the level seen at the load. The scaling is fixed at manufacture and cannot be adjusted by the user. The primary current and voltage settings determine the rated power level for the meter. This in turn affects how demand and energy values are displayed and communicated.

The scaling of the meter is printed on the ratings plate label, and the meter factor is printed on the display label.

Meter scaling also affects the value of output pulses related to energy consumption and the value of 'units' communicated when the meter is read electronically.

The rated power for a CALMU3+ is calculated in the following way:

For 3p 4w meters (C3T) the rated power is (3 x (primary phase to neutral voltage x primary current))

For 3p 3w meters (C3V) the rated power is ( $\sqrt{3}$  x (primary phase to phase voltage x primary current))

**Table 4. Scaling Values for Various Power Levels**

Power (up to)	7 kW	14 kW	24 kW	69 kW	138 kW	240 kW	690 kW	1.4 MW	2.5 MW	7.2 MW	14 MW	25 MW	36 MW
Units (k)	0.1	0.1	0.1	1	1	1	10	10	10	100	100	100	1,000
Default Pulses (k)	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	50
LED flashes per kWh	8000	4000	1600	800	400	160	80	40	16	8	4	1.6	0.8
MV-90 Pulse Multiplier	0.001	0.002	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10

*Example: For an 11 kV, 100 A P3V the rated power is  $1.732 \times 11,000 \times 100 = 1,905,255 \text{ W} = 1.905 \text{ MW}$*

*Example: For a 230 V, 100 A C3T the rated power is  $3 \times 230 \times 100 = 69,000 \text{ W} = 69 \text{ kW}$*

*Note: For a whole-current C3D the rated power is always  $3 \times 230 \times 100 = 69,000 \text{ W} = 69 \text{ kW}$*

## SECTION K: PART NUMBER SYSTEM AND CALMU3+ SPECIFICATION

The table below shows how CALMU3+ part numbers are made up.

**Table 5. CALMU3+ Part Numbers**

Wiring Configuration	Accuracy	CT input	MD Button	Backup	Outputs	Inputs	Terminal Cover	Main Cover
C3D = 230 V 3p 4w Direct Connected	A = Class 2	1 = 1A CT	M = MD reset button	B = Lithium Battery	0 = No outputs	0 = No inputs	S or H = Standard Cover	S = White Cover PACT port only
C1D = 230 V 1p 2w Direct Connected	B = Class 1	5 = 5A CT	0 = no button		1 = 1 output		E or I = Extended Cover	K = Black Cover PACT + 1107
C3T = 230 V 3p 4w CT operated		D = Direct Connected			2 = 2 outputs			J or Z = Black Cover PACT + D Port
C3V = 110 V 3p 3w CT & VT operated					3 = 3 outputs			I = Black Cover PACT only

For example: a 3p 4w CT operated meter with 5A inputs, accuracy Class 1, with MD reset button, and with extended terminal cover, fitted with PACT port only in a white cover would be represented by part number: **C3T B 5 M B 3 0 E S**

<b>Dimensions</b>	165 x 177 x 65 mm	<b>Protection</b>	IP 51 UL 94 V0
<b>Weight</b>	1.3 kg	<b>Burden per Phase</b>	(for 3 phase meter)
<b>Enclosure</b>	ABS / Polycarbonate	Current Circuits	< 0.6VA at 5A, UPF (5 A model) < 0.1 VA at 1A, UPF (1 A model)
		Voltage Circuits	< 0.5 VA