Atlas Series Energy Meters

Mk10 / Mk7

Hardware Reference Manual

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1

Introduction

This reference manual is for the EDMI Atlas series of Energy Meters.

- Mk10 Three Phase Energy Meter (includes Mk10A)

- Mk10D Three Phase Energy Meter with Disconnect

- Mk7A Single Phase Energy Meter

- Mk7C Compact Single phase Energy Meter

- Mk10E High Performance Three Phase Energy Meter

It covers the hardware of the meter, including installation and connections.

The meter is fundamentally an energy meter, measuring the basic quantities of Wh, varh and VAh. Consumption data may be recorded in a load survey, and as time of use data. The meter can also measure a wide variety of instantaneous quantities. The configuration is extremely flexible.

For information on configuring the meter and using it with the EziView software, see the Atlas Software Reference Manual, 1910-E-07.

Using this Manual

Each chapter covers a specific meter type. While all Atlas meters share a common set of functionality, the different meter types cover a broad range of metering applications. Each hardware chapter stands on its own, and does not rely on the contents of other chapters. The information on the LCD interface of all the meters is covered in Chapter 7 "LCD Display".

Conventions Used in this Manual

All dates are in DD/MM/YY format.

References to settings or controls are printed in *Italics*.

The path to a specific menu option is written as:

Menu Level 1 → Menu Level 2 → Menu Level 3

Information with special note (such as safety information) is marked with a .

Additional noteworthy information is marked with a .

Mk10 Specific information will be marked with a . The name Mk10 refers to either the Mk10, Mk10D, MK10A, or the Mk10E

Mk7 Specific information will be marked with a . The name Mk7 refers to either the Mk7A or the Mk7C.

"Clicking" on a button or field means using the left mouse button.

Note that due to variations between computers and improvements in software, the screenshots shown in this manual may vary slightly from the appearance of the software on your system.

For more information

The best source of information should generally be this manual. The table of contents has been organised to make finding information as easy as possible. If you are still having problems though, EDMI support may be contacted via email at support@edmi-meters.com The EDMI web site is located at http://www.edmi-meters.com/.

The online help of EziView also has a wealth of information, and contains more information on advanced functions of EziView such as the scheduler, script files, and reading files.

When contacting EDMI for support you may be asked for the meter serial number, firmware version and EziView version. The serial number is printed on the label, and is the serial number used in EziView to identify the meter. The EziView version is available under *Help → About* in EziView.

All this information will help us help you.

The Mk10 Meter

This chapter covers the basic installation and physical features of the Mk10 meter, including the UPS (Uninterruptable Power Supply), Special I/O and MK10A variants.

Dimensions and Mounting

Figure 2-1 shows the overall dimensions of the meter with a standard terminal cover. The height excludes the buttons and the ANSI fitting if present.

- Figure 2-1 Overall dimensions of the meter

Height = 210 mm, Depth = 74 mm, Width = 166 mm
Height is 240 mm with an extended terminal cover, such as used to house a modem.

This is a view from the back of the meter (Figure 2-2).
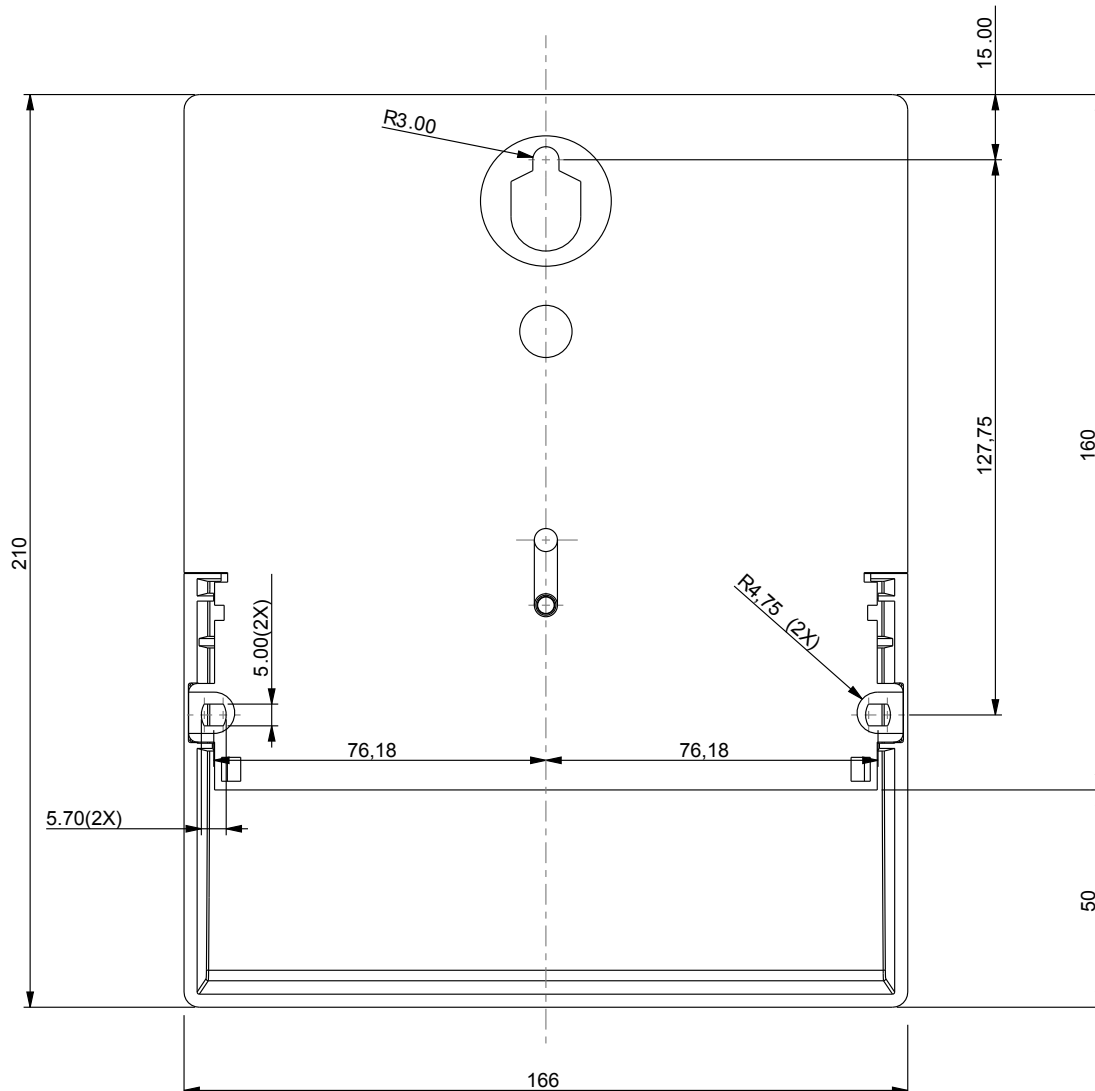
- Figure 2-2 Mounting points, standard terminal cover

Note that the dimension R4.75 is of the standoff, not of the hole. The lower mounting holes are oblong rather than round, to allow some adjustment in the meter position. The 76.18 mm dimension is to the centre of this hole.

All dimensions are in mm.
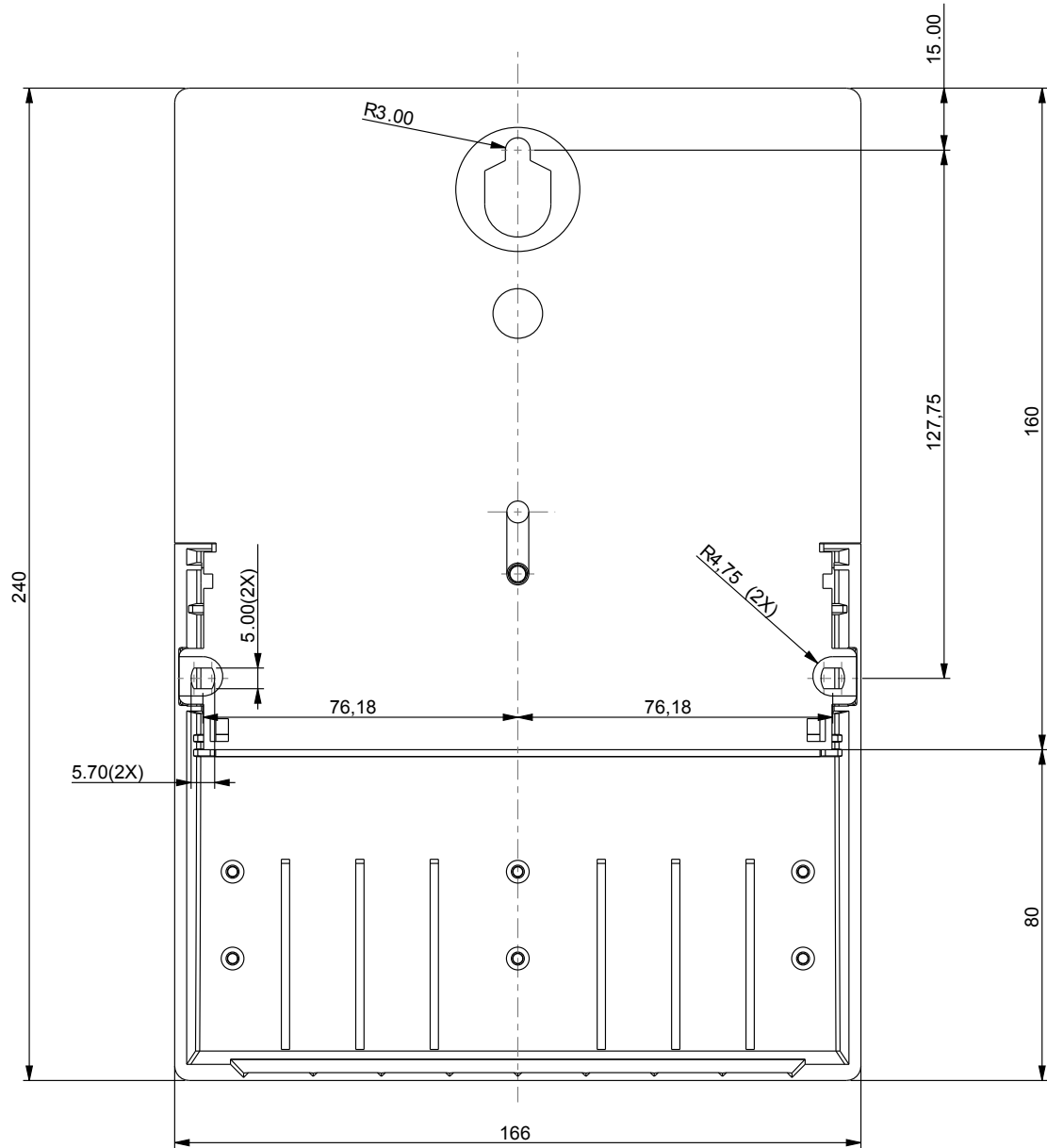
- Figure 2-3 Mounting points, extended terminal cover

For mounting use three screws with a threaded section no larger than 5mm in diameter with a screw head no smaller than 8mm in diameter.

In general:

1. Screw the first (top) screw into the wall. Leave enough space between the head and the wall for the plastic around the keyhole.

2. Hang the meter on the screw using the keyhole in the back of the meter.

3. Insert the remaining two screws (meter base, under the terminal cover) to hold the meter securely.

External Features

Figure 2-4 shows a view of the front of the meter (the specifics of your label will vary).

- Figure 2-4 Front view of the meter with terminal cover fitted

The major parts visible in Figure 2-4 include:

- The LCD display.

- A *Select* button for cycling the display (bottom push button).

- A sealable *Billing Reset* button (optional) to initiate a manual billing reset (top push button).

- Four pulsing LEDs for energy indication (PO1 – PO4) which overlap the first 4 outputs. The special I/O variant has 2 LED's (PO1, PO2), the UPS variant has 1 LED (PO1) – in these variants the LED's are independent of the outputs.

- A FLAG or ANSI port for local connection.

Beneath the terminal cover (accessible by removing the sealable screw on the top middle of terminal cover) is the terminal block for voltage and current, connectors for the pulsing inputs and outputs (optional), the optional RS-232 or RS-485 interface, and the optional external battery

The sealable screws have 2.15mm diameter holes to accommodate standard sealing wire.

Under the Terminal Cover

Most of the connections to the meter occur under the terminal cover. Figure 2-5 shows the terminals available on a standard I/O variant 2 input / 4 output / RS-232 / CT connected meter.

- Figure 2-5 Under the terminal cover of the meter

Diagrammatically, this is shown in Figure 2-6 with the terminal block numbering.
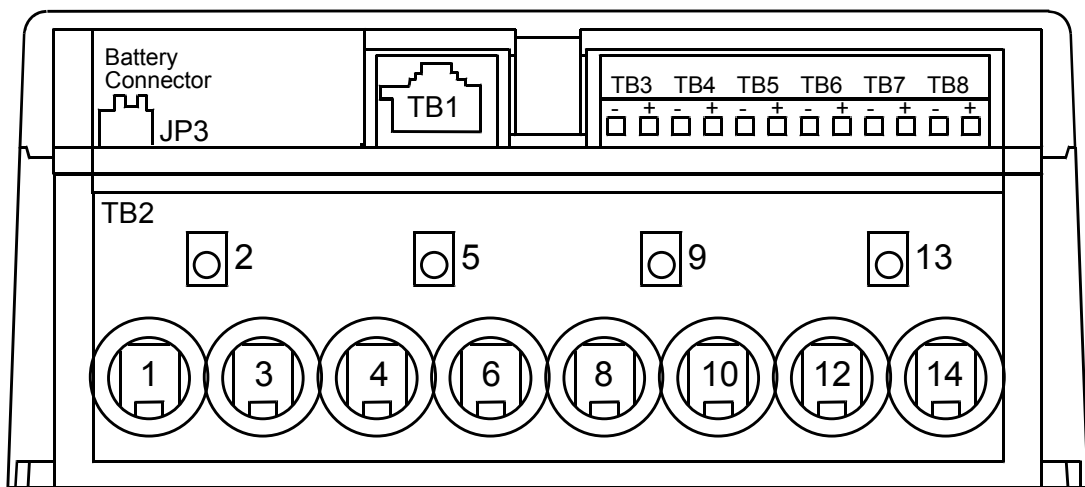
- Figure 2-6 Terminal block diagram

Table 2-1 lists the terminal block connections, standard I/O variant.

Terminal	Description
TB1	RJ45 connector which is hardware configured to either RS485 or RS232, or a 5 way terminal block for RS485.
TB2	Voltage and current inputs.
TB3	I/O - PI5 or PO5.
TB4	I/O - PI6 or PO6.
TB5	I/O - PO1.
TB6	I/O - PO2.
TB7	I/O - PO3.
TB8	I/O - PO4.

- Table 2-1 Terminal block connections

Outputs are BOSFETs, up to 240V, 100mA, AC or DC. Inputs are AC or DC in a range of voltage options. An active input option is not offered on this variant. All I/O's are isolated from each other to 2kV, except for active inputs which share a supply with the modem port. All I/O are isolated from the line (neutral) and TB1 by 4kV.

Special I/O Variant

This variant separates the LED's from the I/O, and provides more I/O type options. Figure 2-7 shows the terminal layout, and Table 2-2 lists the terminal block connections.
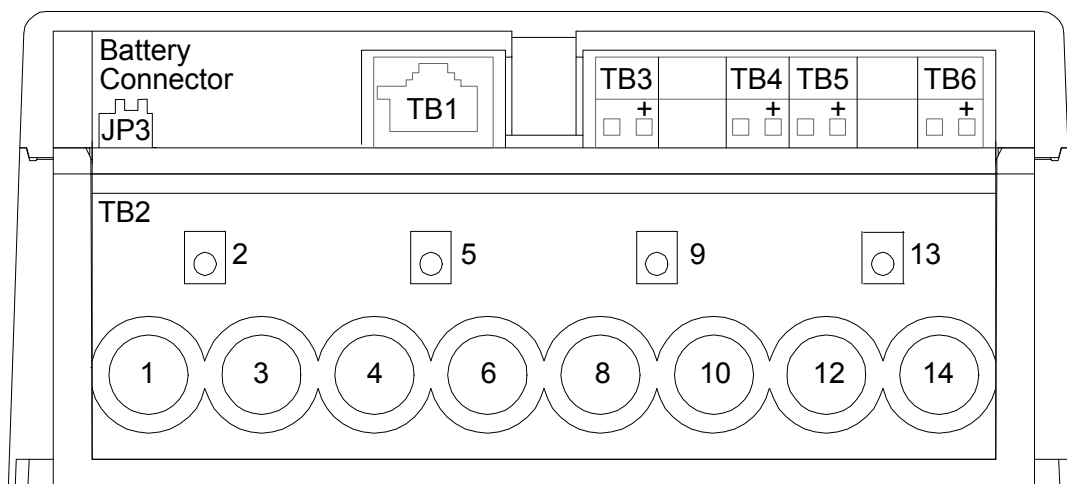
- Figure 2-7 Special I/O variant terminal block diagram

Terminal	Description
TB1	RJ45 connector which is hardware configured to either RS485 or RS232, or a 5 way terminal block for RS485.
TB2	Voltage and current inputs.
TB3	I/O - PI3 or PO3.
TB4	I/O - PI4 or PO4.
TB5	I/O - PI5 or PO5.
TB6	I/O - PI6 or PO6.

- Table 2-2 Special I/O Terminal block connections

All 4 I/O can be either SØ Outputs, BOSFET Outputs or 240V/110V/48V/12V/5V Inputs. PO3 and PO6 have the option of a 2A, 240V relay. TB4 and TB5 should not be considered as isolated from each other (1mm creepage between them). Isolation of TB1 to TB3, TB3 to TB4 and TB5 to TB6 is 4kV (unless active inputs are fitted, in which case there is no isolation between TB1 and the active inputs). All I/O are isolated from the line (neutral) by 4kV.

Mk10A Variant

This variant has similar I/O options to the special I/O variant. Figure 2-8 shows the terminal layout, and Table 2-3 lists the terminal block connections.
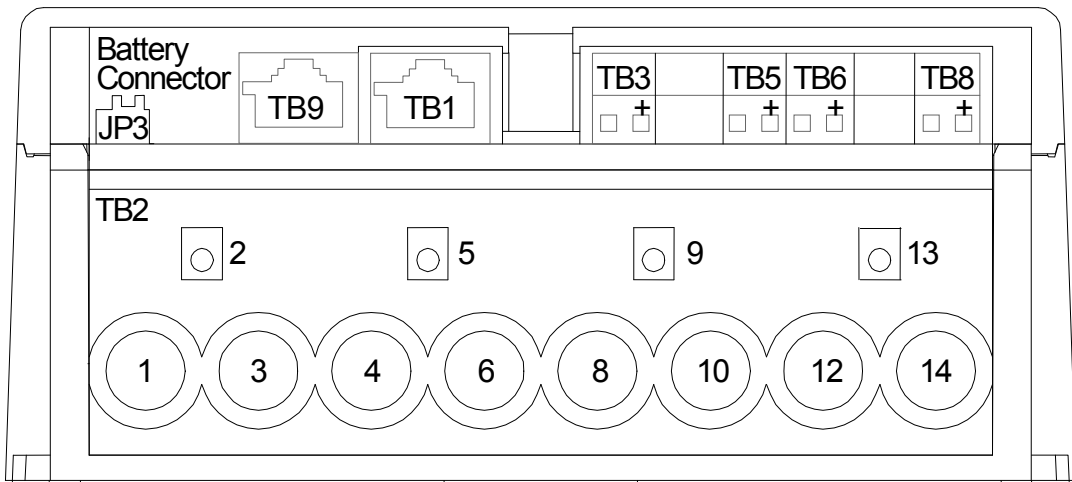
- Figure 2-8 Mk10A variant terminal block diagram

Terminal	Description
TB1	RJ45 connector which is hardware configured to either RS485 or RS232, or a 3 way terminal block for RS485.
TB2	Voltage and current inputs.
TB3	I/O - PI3 or PO3.
TB5	I/O - PI4 or PO4.
TB6	I/O - PI5 or PO5.
TB8	I/O - PI6 or PO6.
TB9	RJ45 connector which is hardware configured to RS232 or RS485.

- Table 2-3 Mk10A Terminal block connections

All 4 I/O can be either SØ Outputs, BOSFET Outputs or 240V/110V/48V/12V/5V Inputs. PO3 and PO6 have the option of a 2A, 240V relay. TB5 and TB6 should not be considered as isolated from each other (1mm creepage between them). Isolation of TB1 to TB3, TB3 to TB5 and TB6 to TB8 is 4kV (unless active inputs are fitted, in which case there is no isolation between TB1 and the active inputs). All I/O are isolated from the line (neutral) by 4kV.

UPS Variant

The UPS variant offers UPS backup, and separates the LED from the I/O. Only Active inputs are available though. Figure 2-9 shows the terminal layout, and Table 2-2 lists the terminal block connections.
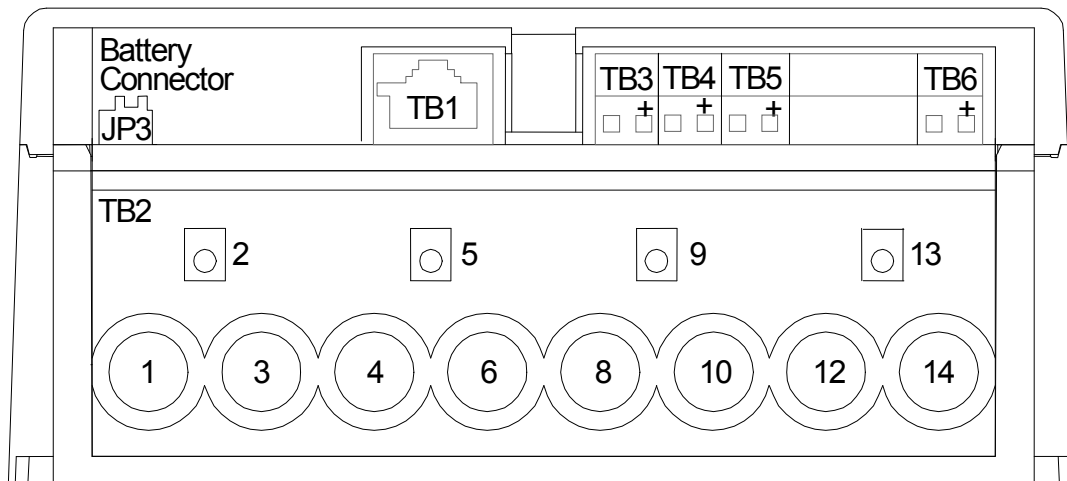
- Figure 2-9 UPS variant terminal block diagram

Terminal	Description
TB1	RJ45 connector which is hardware configured to either RS485 or RS232, or a 5 way terminal block for RS485.
TB2	Voltage and current inputs.
TB3	Active Input - PI3.
TB4	Active Input - PI4.
TB5	Active Input - PI5.
TB8	UPS Battery connector.

- Table 2-4 UPS Terminal block connections

All 3 inputs are active. Thus there is no isolation between TB1, TB3, TB4, and TB5. All inputs and TB1 are isolated from the line (neutral) by 4kV. Note in some revisions of the PCB show +/- indications opposite to the actual board. The right hand terminal of each pair is the ground connection.

Terminal Spacing

Figure 2-10 gives the terminal spacing of TB2.
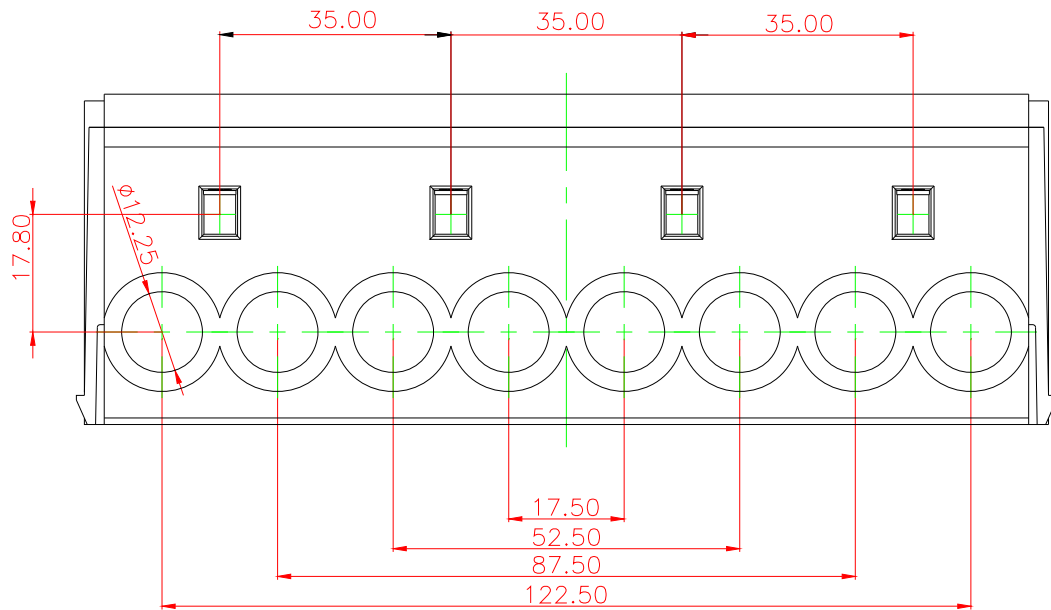
- Figure 2-10 TB2 terminal spacings

There are several styles of terminal in use – Table 2-5 summarises their inner dimensions.

Meter Type	Terminal Type and Profile	Dimensions
CT	Current Square	8.5 mm x 8.0 mm
CT	Current Round	9.0 mm Ø
Whole Current	Current Square	8.5 mm x 9.0 mm
Whole Current	Current Round	9.0 mm Ø
All	Voltage	3.0 mm Ø

- Table 2-5 Terminal sizes

New Terminal Block

There is an updated terminal block design. This provides shrouding for the current terminals, numbering on all terminals, external VT to CT links (instead of internal links), and an optional finger guard. The terminal spacing and locations are unchanged. Figure 2-11 shows the new layout.

- Figure 2-11 New style terminal block of the meter

Finger Guard

An optional finger guard may be fitted over the TB2 terminal screws in meters fitted with the new style terminal block. This can help prevent accidental contact with the supply voltage, as well as allowing these connections to be sealed.

- Figure 2-12 The finger guard in place

Terminal Cover Tamper Detect

The Mk10A meter has an optional switch that can detect the opening of the terminal cover. It is located above the battery connector. The meter can generate an EFA alarm

and an event in the log when the switch is released by someone opening the terminal cover.

Meter Lid Tamper Detect

The Mk10A meter has an optional switch that can detect the opening of the meter lid. The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the meter lid.

Under the Meter Lid

Removing the sealable screw allows the meter lid to be removed. Generally connections to the I/O connectors do not need to be detached to allow the cover to be removed. Removal of the meter lid is required to access the *Config Jumper*, and to add or remove the CT to VT links on whole current meters with old style terminal blocks.

Care must be taken as dangerous voltages are present in the circuitry under the meter lid while the meter is active. Most of the circuitry is at neutral potential.
Even when the meter is not powered, care should be taken to prevent electrostatic damage to the circuitry of the meter.

CT to VT Links

Whole current meters have CT to VT links between TB2 terminals 1 and 2, 4 and 5, 8 and 9, 12 and 13 (designated number as shown in Figure 2-5). These links may need to be removed to allow testing on some types of test bench. The old terminal block design and the new design have different methods of connecting the links.

In the old design the links are under the meter lid, and require the meter seal to be broken to access them. Figure 2-13 shows the location of the link for phase A (as indicated in the circle), just above the terminal block. There is a link each for phases A, B, C and Neutral, though the neutral link does not generally need to be removed.

To access to the CT-VT links, remove the lid cover and slide the CPU card upward to expose the CT-VT link enough for access using screwdriver. Care must be taken on ESD protection by wearing ESD wrist strap, or ensure that no component is touched. ESD can damage certain components in the circuitry, so avoid touching components other than the screws.

- Figure 2-13 Location of the CT to VT links

Figure 2-14 shows the screw used at this link.

- Figure 2-14 The screw used to form the CT-VT link

It is important to leave the other screws in place, as they are part of the connection of the voltage terminals to the meter.

In the new design, the links are located in the terminal block area near the current screws. Figure 2-15 shows the location of the link screws, with the phase A link highlighted. There is no link for the neutral – that link is made internally in a similar fashion to the old style terminal block, and should not need to be removed.

- Figure 2-15 Location of the CT to VT links

To break the link the screws should be removed, leaving just the metal tab (Figure 2-16).

- Figure 2-16 The removed screw and disconnected link

Config Jumper

The *Config* jumper offers a level of hardware security to the meter – the jumper needs to be fitted to allow calibration and recovery of lost passwords. The jumper is located under the meter lid, half way up the far left side of the circuit board (Figure 2-17). A jumper is fitted across the bottom set of pins marked *Config*. The top set of pins marked *FTest* are for factory use only.

In the Mk10A the jumper is located above the LCD screen towards the right hand side.

- Figure 2-17 Location of the *Config* jumper

Connections in Detail

Current and Voltage
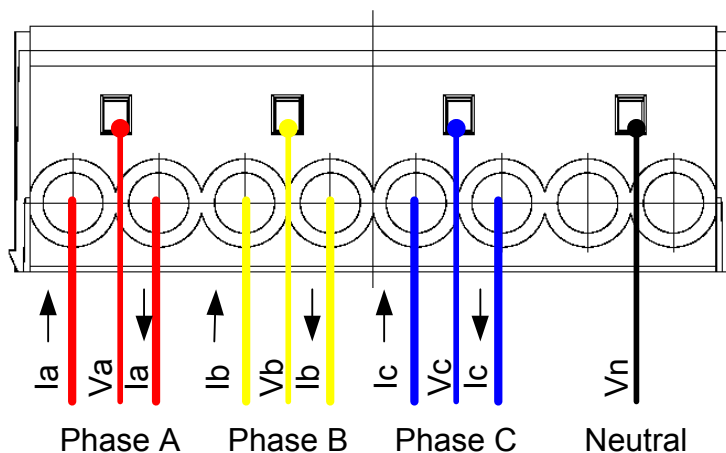
- Figure 2-18 TB2 CT and VT connections for 3 element

Figure 2-18 shows the connection methods in 3 element (4 wire) mode. The nominal voltage input range is 240 VAC. The absolute limits are 140VAC to 290VAC. The current range depends on the current range of the meter, and should be limited to Imax.

In 3 element mode (4 wire) the maximum line to neutral voltage is 290V and the maximum line to line voltage is 500V. At any higher voltage the meter may not operate correctly and damage may occur.
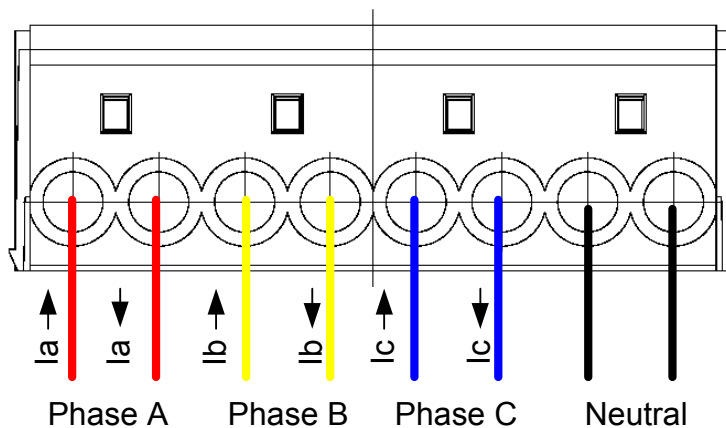
- Figure 2-19 Connections for 3 element whole current

Figure 2-19 shows the connections for a whole current meter. The neutral connection must be made, even if it is not connected to both 12 and 14. Whole current meters have links connecting TB2 terminals 1 to 2, 4 to 5, 8 to 9, and 12 to 13 to 14. The links are fitted under the main meter cover, discussed earlier in this chapter. The same maximum voltage restrictions apply as for CT meters.

Mk10 Serial Port Configurations

The Mk10 meter has a number of single serial port options, listed in Table 2-6.

Type	Modem Communications
0	None
1	RS232 with RJ45
2	RS485 (4-wire) with RJ45
3	RS485 (4-wire) with Screw Terminals
5	RS232 with RJ45 and GSM/GPRS Power Supply
A	A-Band PLC
C	C-Band PLC

- Table 2-6 Mk10 Serial port options

RS-232

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use an RJ45 to DB9 connector adapter. RTS/CTS hardware handshaking is not supported. See Table 2-7 for Mk10 connection details. Pin 1 of the RJ45 is furthest from the battery (i.e. on the right hand side).

RS232D RJ45 From Meter	RS232C DB9 To Modem	RS232C DB9 To PC (Null)	Description	Full Name
TB1-1 [1]	(9)	(9)	Power Out	+5V,140mA output
TB1-2	1	4	CD	Carrier Detect (to meter) Not available Mk10A
TB1-3	4	1	DTR	Data Terminal Ready (from meter) Optional on Mk10A
TB1-4	5	5	GND	Ground
TB1-5	2	3	RX	Receive Data (to meter)
TB1-6	3	2	TX	Transmit Data (from meter)
TB1-7				
TB1-8				

- Table 2-7 Mk10 RS-232 connections

[1] On Mk10 type 1 ports TB1-1 may be connected to a +5V power source from the meter. To do this, fit a jumper between pins 6 and 7 of PL8. PL8 is a 9 way jumper block located under the meter lid just behind TB1. Pin 1 is on the right hand side, near the PL8 label. This voltage is enough for small PSTN modems, but not for GSM. A modem power supply card may be factory fitted to the Mk10 meter (type 5), in which case the meter can supply 7V at 2W (no jumpers need be fitted in this case).

RS-485

The RS-485 port on the meter has the factory option of either an RJ45, or a 5 way terminal block. Table 2-8 lists the connections. Pin 1 of the RJ45 is furthest from the battery (i.e. on the right hand side). Pin 1 of the terminal block is closest to the battery (i.e. on the left hand side)

RJ45	Terminal Block	Description	Full Name
TB1-1			Not Connected
TB1-2			Not Connected
TB1-3	1	TX+ (A)	Transmit +
TB1-4	5	GND	Ground
TB1-5*		+5	+5V,140mA output
TB1-6	2	TX- (B)	Transmit Data
TB1-7	4	RX- (B)	Receive -
TB1-8	3	RX+ (A)	Receive +

- Table 2-8 RS-485 connections

*TB1-5 may be connected to a +5V power source from the meter. To do this, fit a jumper between pins 7 and 8 of PL8. PL8 is a 9 way jumper block located under the meter lid just behind TB1. Pin 1 is on the right hand side, near the PL8 label. This supply is not sufficient to supply a GSM modem.

To operate the meter in two wire mode, simply wire TX- to RX- and TX+ to RX+. This can also be achieved inside the meter. Fit a jumper between pins 1 and 2 of PL8, and between pins 3 and 4 of PL8. PL8 is a 9 way jumper block located under the meter lid just behind TB1. Pin 1 is on the right hand side, near the PL8 label.

Note that the 5-pin terminal block has a different pinout to the EDMI mk6 and mk3 meter RS485 ports.

See Figure 2-5 and Figure 2-6 for the location of the connector. The 5 way terminal block is fitted in the same place (instead of) the RJ45 shown.

PLC

A meter with PLC communications has no TB1 fitted. Communications are made via the power line, coupled to Phase A and Neutral.

Mk10A Serial Port Configurations

The Mk10A meter has an option of one or two RS-232 ports, which can be arranged in a number of configurations with an RS485 port. The two ports are called Modem and SCADA. The possible options are listed in Table 2-9, which lines up with the order code options (Rev 001).

Type	Port Arrangement
0	None
1	**Modem**: RS232 (RJ45 TB1, with DTR), no modem power *Basic RS232 port operation*
2	**SCADA**:RS485 4-wire (2xRJ45 , TB9 &TB1), no modem power *Basic 4-wire 485 operation, two identical RJ45's to allow easy daisy chaining*
5	**Modem**: RS232 (RJ45 TB1, with DTR); with modem **power** *Basic modem operation, with modem power*
7	**Modem**: RS232 (RJ45 TB1); **SCADA**: RS232 (RJ45 TB1, pins 7&8); with modem **power** *Two RS232 ports on the one RJ45.*
9	**Modem**: RS232 (RJ45 TB1); **SCADA**: RS232 (Slave RJ45 TB9, pins 5&6); with modem **power** *Two RS232 ports, each on their own RJ45.*
G	**Modem**: RS232 (RJ45 TB9); **SCADA**: RS485 4-wire (Slave RJ45 TB1); with modem **power** *RS232 port on one RJ45, and a 4-wire RS485 port on the second RJ45*
S	**Modem**: RS232 (RJ45 TB9); **SCADA**: RS485 2-wire (Screw Terminal TB1); with modem **power** *RS232 port, and a 2-wire RS485 port on a 3-way terminal block*
T	**SCADA**: RS485 4-wire (2x RJ45, TB9 &TB1); with modem **power** *Basic 4-wire 485 operation, two identical RJ45's to allow easy daisy chaining*
U	**Modem**: RS232 (RJ45 TB1); **SCADA**: RS485 2-wire (RJ45 TB1, pins 7&8); with modem **power** *RS232 port, with a 2-wire RS485 port on the same RJ45 connector.*
V	**Modem**: RS232 (RJ45 TB1); **SCADA**: RS485 2-wire (RJ45 TB1, pins 7&8 **plus** Slave RJ45 TB9, pins 7&8); with modem **power** *RS232 port, with a 2-wire RS485 port on the same RJ45 connector, and a second* *connector. Useful for master/slave*
W	**SCADA**: RS485 2-wire (Screw Terminals TB1) *Basic 2-wire RS485 on a 3-way terminal block*

- Table 2-9 Mk10A Serial port options

Where only one RJ45 is fitted it is TB1 that is fitted. TB1 is the right hand RJ45 and TB9 is the left hand RJ45 (Mk10A only).

Type 'V' is particularly useful for master slave arrangements using identical build meters. To share a modem between several meters, a modem is plugged into TB1 of the 'master' designated meter, using a cable that omits pins 7&8. A normal 'all wires' patch cable can then be used to connect TB9 to TB1 of the next meter, and the same TB9 to TB1 connection can be continued between all the meters. Note that normally

when the master meter cycles the power on the modem its RS485 port would stop working – in this configuration the RS485 port receives power from the following meter in the chain, useful in some situations (eg access to RS485 bus from the optical port of the master meter).

The options with modem power out are configured such that an externally applied voltage on the power pin (<24VDC) will not damage the meter. Note that the MK10A provides power on pin 1 rather than pin 5 for RS485 options, which is different to many of the other EDMI meters – this allows better integration of the multiple ports.

The connection on the label is indicated using a range of symbols that explain what the connections are. For instance:
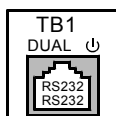
corresponds with a Mk10A Type 7 port. There is only one RJ45 (TB1), it is a dual connector (2 serial ports on the one connector), power is supplied (⏻), and both ports are RS232 (the top port is the Modem port, the bottom is the SCADA port).

Table 2-10 and Table 2-11 show the Mk10A connections for TB1 for each configuration type, and Table 2-12 shows the connections for TB9 where fitted. The symbols are explained in Table 2-13. A '2' suffix indicates a SCADA port, no suffix indicates a modem port.

Right Hand RJ45	Port Type						
	1	2	5	7	9	G,T	U,V
TB1-1			+V	+V	+V	+V	+V
TB1-2							
TB1-3	DTR	TX2+	DTR			Tx2+	
TB1-4	GND	GND	GND	GND	GND	GND	GND
TB1-5	RX		RX	RX	RX		RX
TB1-6	TX	TX2-	TX	TX	TX	TX2-	TX
TB1-7		RX2-		RX2		RX2-	Tx2-/Rx2- (B)
TB1-8		RX2+		TX2		RX2+	Tx2+/Rx2+(A)

- Table 2-10 Mk10A TB1 connections

Terminal Bock	Port Type	
	S	W
TB1-1	Tx2+/Rx2+(A)	Tx2+/Rx2+(A)
TB1-2	Tx2-/Rx2- (B)	Tx2-/Rx2- (B)
TB1-3	GND	GND

- Table 2-11 Mk10A TB1 Terminal block connections

Left Hand RJ45	Port Type				
	2	**9**	**G,S**	**T**	**V**
TB9-1		+V	+V	+V	+V
TB9-2					
TB9-3	TX2+			TX2+	
TB9-4	GND	GND	GND	GND	GND
TB9-5		RX2	RX		
TB9-6	TX2-	TX2	TX	TX2-	
TB9-7	RX2-			RX2-	Tx2-/Rx2- (B)
TB9-8	RX2+			RX2+	Tx2+/Rx2+(A)

- Table 2-12 Mk10A TB9 connections

Symbol	Direction	Description
+V	Output	External Modem supply: 12-20 VDC at 3.6W
GND	Output	Ground for all signals and supply
TX	Output	RS232 Transmit
RX	Input	RS232 Receive
DTR	Output	RS232 Data Terminal Ready
CD	Input	RS232 Carrier Detect
TX+	Output	4-wire RS485 Transmit + (A)
TX-	Output	4-wire RS485 Transmit - (B)
RX+	Input	4-wire RS485 Receive + (A)
RX-	Input	4-wire RS485 Receive - (B)
Tx+/Rx+(A)	I/O	2-wire RS485 Transmit/Receive + (A)
Tx-/Rx- (B)	I/O	2-wire RS485 Transmit/Receive - (B)
Blank		No Connection

- Table 2-13 Symbol Descriptions

See Figure 2-8 for the location of the RJ45 connector. It is designated as TB1.

FLAG Port

The meter can have either a Flag Port or an ANSI Port. Use a standard FLAG (IEC1107 physical standard) read head to connect the meter to a PC.

Note that it has occasionally been found that some FLAG heads need to be rotated 180 degrees for them to work. If you have problems try this.

ANSI Port

The meter can have either Flag Port of ANSI Port. Standard Flag and ANSI read heads should work with the meter. Please note that older EDMI ANSI read heads will not work with the meter. To use a smart read head that can automatically switch polarity, set the DTR line to be low – see *Configure* in the *Site Properties* section of the *EziView Basics* chapter in the Atlas Software Reference Manual.

Inputs

The inputs are passive and are isolated from all other circuits, including the other inputs. There are a variety of input voltages that may be ordered with the meter, e.g. 110V and 240V, down to 5V. Under voltage will cause the input to trigger erratically or not at all, while over voltage will cause excessive heat dissipation and possible damage to the meter.

The rated voltage is the voltage that must be applied between the two terminals of the input. The inputs work with any polarity, and with AC or DC signals. There are a maximum of 2 inputs for the standard I/O variants (Table 2-1), 4 inputs for the special I/O variant (Table 2-2), and 3 for the UPS variant (Table 2-4).

Active inputs are also available as a factory option. They use power from the serial port, and are thus not isolated from the serial port. In this case simply shorting between the input terminals will cause the input to trigger. The maximum external impedance is 500 ohms. Note that power is drawn from the isolated serial port supply, and the inputs will not work while the serial port is powered down to cycle power to a modem. They will continue to operate on a UPS meter when running from the UPS battery.

Outputs

There are several types of outputs available. All outputs are isolated from all other circuits, including other I/O. See Table 2-1, Table 2-2, and Table 2-4 for details of isolation and connections.

The SØ outputs are designed to switch up to 24VDC and 24mA.

The relay outputs are rated to 2A, 240VAC with an inductive load, or 5A, 240VAC for the high current version. These outputs should not be used as pulsing outputs for transmitting energy pulses, as the output contacts are subject to contact bounce and are not rated for continuous switching.

The BOSFET outputs are rated up to 240V, 100mA. They may switch either AC or DC voltages, any polarity.

Battery

The battery is used to run the clock during loss of power. It also allows the meter LCD to be activated while main power is not available.

The meter comes with an optional internal or external battery.

The external battery is a 3.6V, 700mAh Lithium battery, or a 3.0V, 700mAh Lithium battery. The Mk10A only supports the 3.0V battery. The internal battery is a 3.0V, 700mAh Lithium battery. If both internal and external batteries are fitted, the meter will use both.

If an internal battery is used, a jumper will be connected to JP3 pin 1 and pin 2. To use an external battery, remove the jumper and plug the battery connector to pin 2 and 3 (polarized) of JP3. The external battery is clipped into the compartment to the right of

JP3. In the Mk10A if TB9 is fitted the battery can be fitted end in. The battery cable should be routed away from the communication lines, since it is at neutral potential.

Replacement batteries may be ordered from EDMI separately. A low battery indicator is displayed on the LCD if the battery is not present or is depleted – the level this occurs at can be configured. The battery usage life is longer than 10 years on continuous backup with either of the 700mAh batteries at 25°C. In normal operation the battery should last for more than 10 years.

To eliminate the possibility of data loss it is best to change the battery while the meter is running. Care must be taken as the battery is at the potential of the neutral terminal.

The battery is at the potential of the neutral terminal. If conditions (such as wiring configuration) make this a dangerous operation then steps should be taken to ensure that it is safe to do so. While the risk of coming into contact with the conductors during a battery change is minimal, care must be exercised.

UPS Battery

This battery is fitted to the UPS variant to supply the meter and modem in case of power outage. It is separate to the normal battery used to run the clock during loss of power and which allows the LCD to be woken up.

The UPS battery is a rechargeable 500mAh Ni-MH battery.   It is a custom battery, replacements are available from EDMI. It connects to PL11, a small connector towards the right of the meter.

In operation the meter switches over to the UPS battery when power is lost, to allow the meter to contact a server via GPRS and communicate the event. The meter turns off the UPS supply 2 minutes after the supply was lost.

The meter also measures the UPS battery voltage and will signal a battery alarm if the battery voltage is too low of too high, or no battery is fitted. It may take 24 hrs for the battery to reach the 5.4V needed for proper operation, and the meter will not switch to UPS if it is too low.

The battery is at the potential of the neutral terminal. If conditions (such as wiring configuration) make this a dangerous operation then steps should be taken to ensure that it is safe to do so.

LCD/Select Button

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and 7 (6 for Mk10A) seven-segment digits to display description (Figure 2-20, see Chapter 7 'LCD Display' for other variants). It has arrows to indicate import and export for active and reactive energies, indicators for phase voltage, indicators for display sets A and B, battery indicator, connection type indicator for connection through local or remote port and units and multipliers.

The LCD can come with or without a backlight. The backlight may be set to only activate while the LCD is in use, which is recommended to reduce power consumption. The turn on time of the backlight can be configured using EziView. The backlight does not operate when running on the UPS battery.
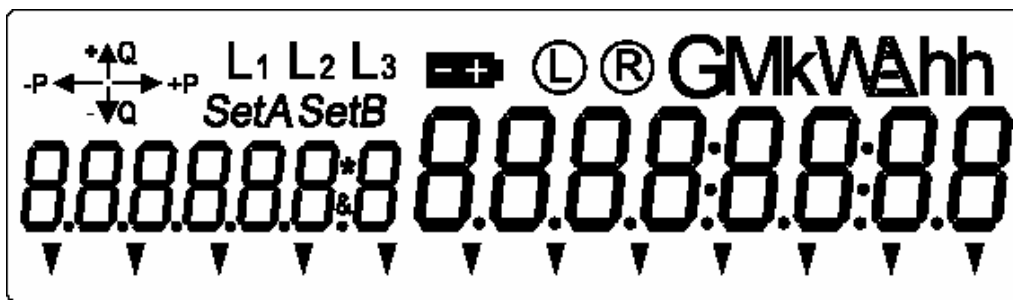
- Figure 2-20 Mk10 LCD with all segments turned on

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

For more detailed information on the LCD and *Select* button see Chapter 7: "LCD Display".

Billing Reset Button

The *Billing Reset* button is the top of the two pushbuttons beside the display. The push button has a 2.5mm diameter hole through it, allowing it to be sealed using standard sealing wire. EziView can disable the push button - go to Security Setup and check the *Billing Reset Button Disabled* checkbox.

Servicing

The meter is not designed for field servicing and has no user serviceable parts. The meter has no internal fuses. In the event of failure of the meter, contact EDMI or your local agent for servicing.

.The Mk10D Meter

This chapter covers the basic installation and physical features of the Mk10D meter.

Dimensions and Mounting

Figure 3-1 shows the overall dimensions of the meter with a standard terminal cover. The height excludes the buttons and the ANSI fitting if present.

- Figure 3-1 Overall dimensions of the meter

Height = 262 mm, Depth = 95 mm, Width = 175 mm

Height is 290 mm with an extended terminal cover.

Figure 3-2 is a view from the back of the meter.

For mounting use 3 screws with a threaded section not larger than 5mmØ with a screwhead not smaller than 8mmØ.
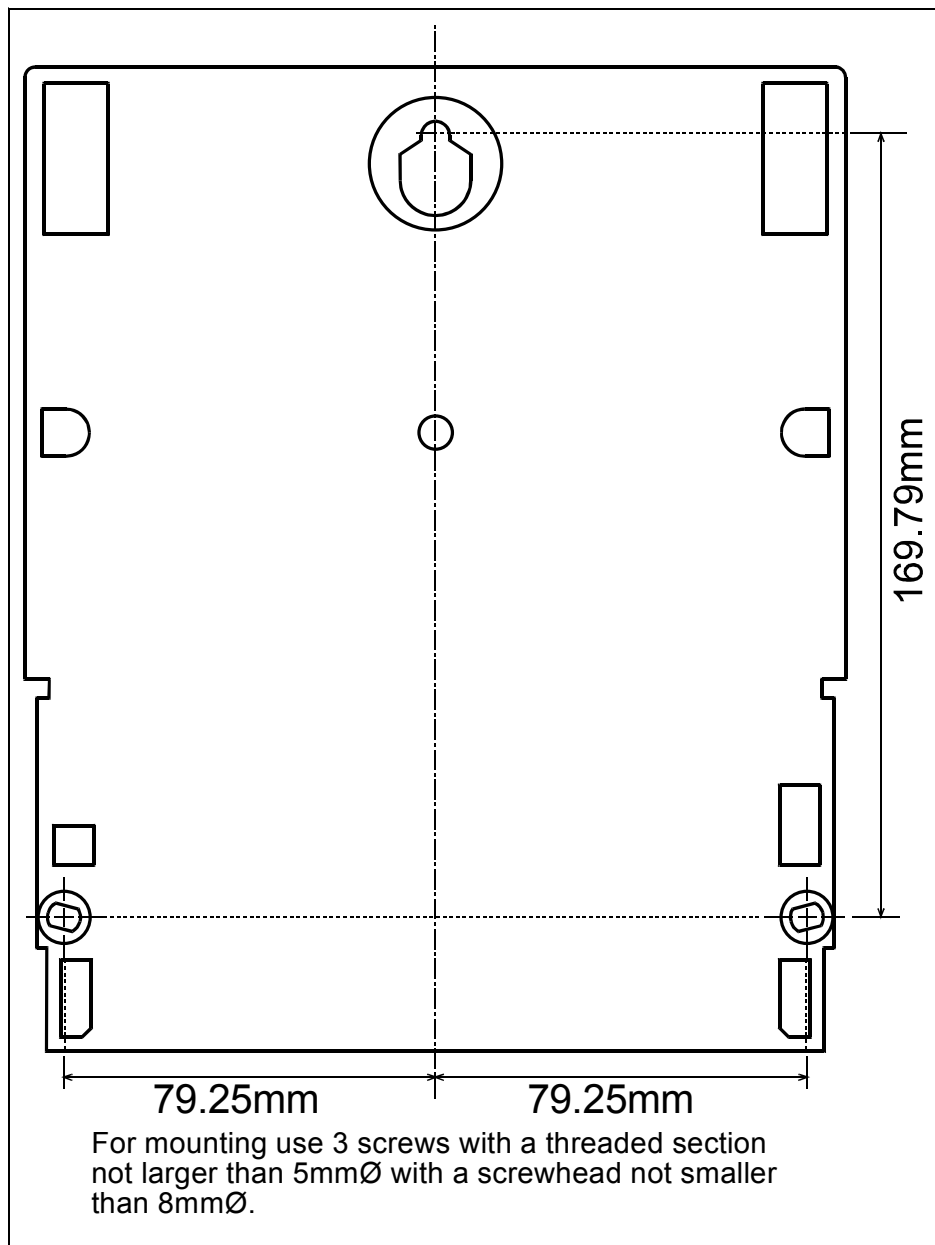
- Figure 3-2 Mounting points

The meter is mounted using three screws. In general:

1. Screw the first (top) screw into the wall. Leave enough space between the head and the wall for the plastic around the keyhole.

2. Hang the meter on the screw using the keyhole in the back of the meter.

3. Insert the remaining two screws (meter base, under the terminal cover) to hold the meter securely.

External Features

Figure 3-3 shows a view of the front of the meter (the specifics of your label will vary).

- Figure 3-3 Front view of the meter with terminal cover fitted

The major parts visible in Figure 3-3 include:

- The LCD display.

- A *Select* button for cycling the display (bottom push button).

- A sealable *Billing Reset* or *Reconnect* button (optional) to initiate a manual billing reset (top push button).

- Two pulsing LEDs for energy indication (PO1 and PO2).

- A FLAG or ANSI port for local connection.

Beneath the terminal cover (accessible by removing the two sealable screws on the top of the terminal cover) is the terminal block for voltage and current, connectors for the pulsing inputs and outputs (optional), and the optional RS-232 or RS-485 interface.

The sealable screws have 2.15mm diameter holes to accommodate standard sealing wire.

Under the Terminal Cover

Most of the connections to the meter occur under the terminal cover. Figure 3-4 shows the terminals available on a 4 I/O / RS-232 meter.
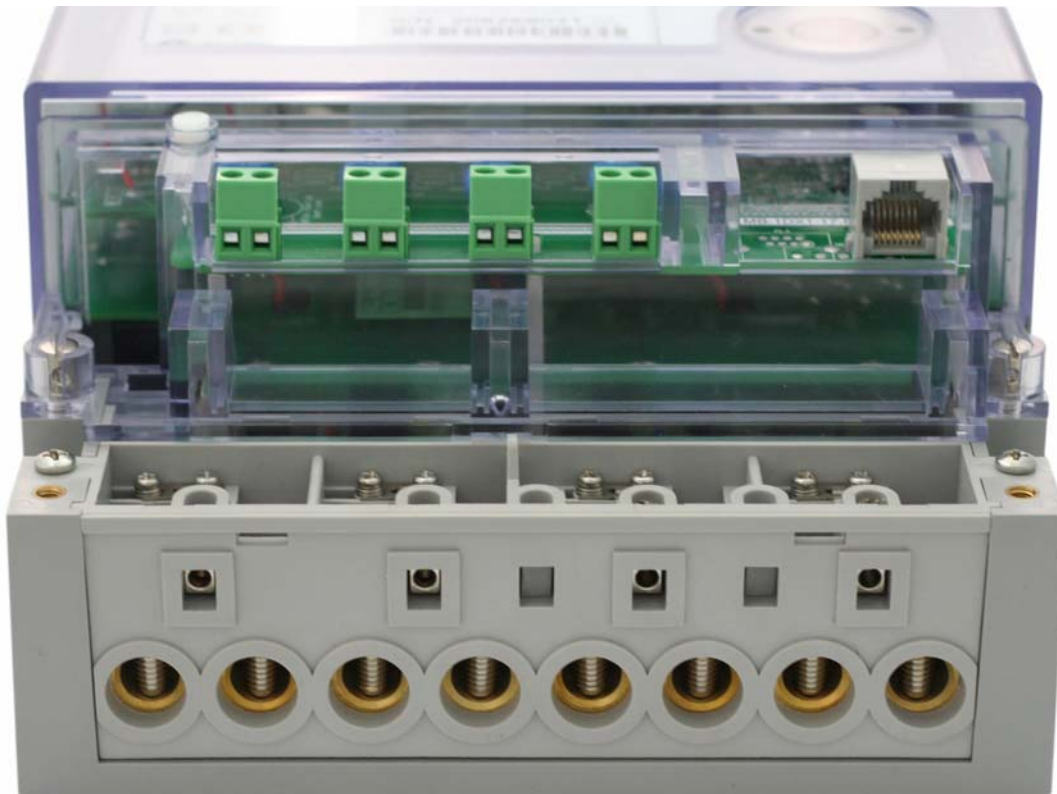
- Figure 3-4 Under the terminal cover of the meter

Diagrammatically, this is shown in Figure 3-5 with the terminal block numbering.
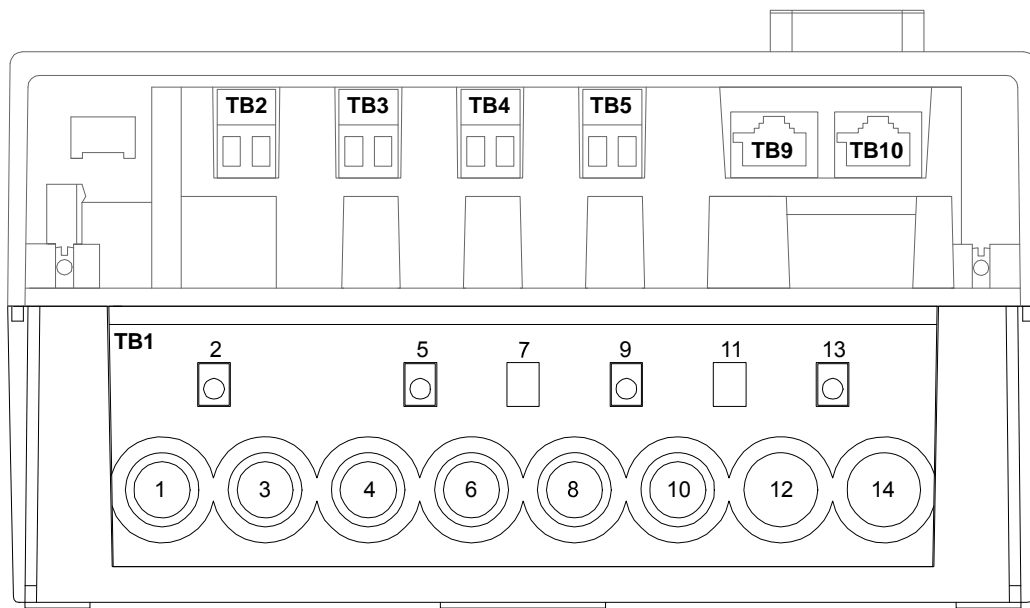
- Figure 3-5 Terminal block diagram

Table 3-1 lists the terminal block connections.

Terminal	Description
TB1	Voltage and current inputs.
TB2	Input PI3 or Output PO3.
TB3	Input PI4 or Output PO4.
TB4	Input PI5 or Output PO5.
TB5	Input PI6 or Output PO6.
TB9	Second RJ45 connector for some communication options.
TB10	RJ45 connector which is hardware configured to either RS485 or RS232, or a 5 way terminal block for RS485.

- Table 3-1 Terminal block connections

Figure 3-6 gives the terminal spacing of TB1.
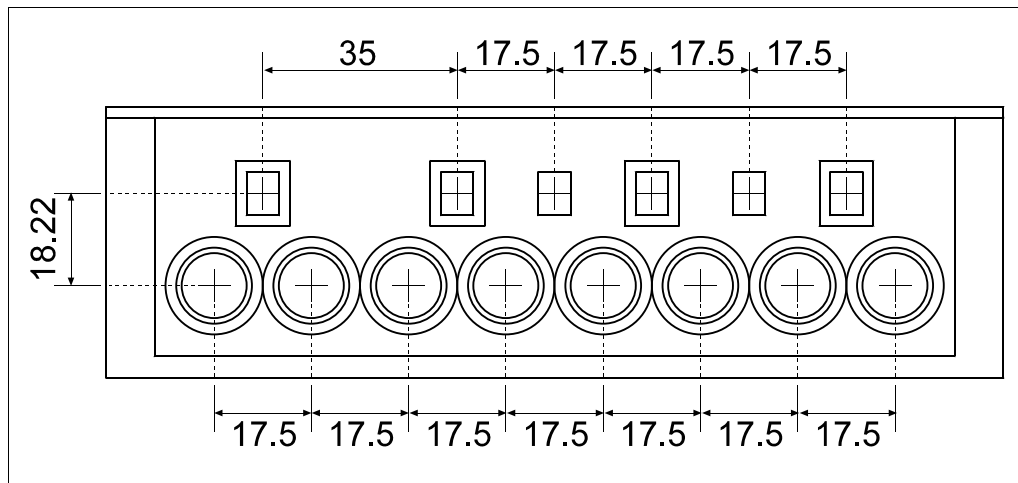
- Figure 3-6 TB1 terminal spacing

Terminal Block Variations

There are two variations of the terminal block – one with internal VT to CT links, and one with external VT to CT links. The external model includes numbering on all terminals and an optional sealable finger guard. The terminal spacing and locations are unchanged.

Terminal Cover Tamper Detect

The meter has an optional switch that can detect the opening of the terminal cover. It is located above and to the left of the terminals (See Figure 3-7). The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the terminal cover.

- Figure 3-7 The terminal cover tamper detect button

Under the Meter Lid

Removing the sealable screw allows the meter lid to be removed. Generally connections to the I/O connectors do not need to be detached to allow the cover to be removed. Removal of the meter lid is required to access the *Config Jumper*, and to add or remove the CT to VT links on meters with old style terminal blocks.

⚠️ Care must be taken as dangerous voltages are present in the circuitry under the meter lid while the meter is active. Most of the circuitry is at neutral potential.
Even when the meter is not powered, care should be taken to prevent electrostatic damage to the circuitry of the meter.

CT to VT Links

Whole current meters have CT to VT links between TB1 terminals 1 and 2, 4 and 5, 8 and 9, 12 and 13. There is also a fixed link between 12 and 14. These links may need to be removed to allow testing on some types of test bench. There are two options for removing them. The first option has external VT to CT link connections. Figure 3-8 shows the location of the links, just above the terminal block.

- Figure 3-8 Location of the CT to VT links.

To remove the link connections either loosen the screws, slide the metal shims to the right and retighten (Figure 3-9), or remove the left hand screws completely for better isolation (Figure 3-10).

- Figure 3-9 Meter with the CT to VT links disconnected by sliding shims.

- Figure 3-10 Meter with the CT to VT links disconnected by removing screws.

The second option has no external VT to CT links, so the meter lid must be removed to change the links. Figure 3-11 shows the location of the links in this case, just above the terminal block.

- Figure 3-11 Location of the CT to VT links.

To remove the link connections, remove the four screws and washers from the deeper set of holes. This disconnects the links. Figure 3-12 shows the meter with the screws removed.
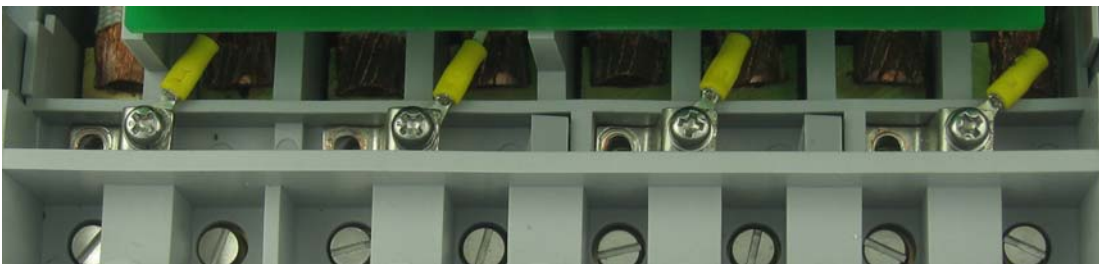
- Figure 3-12 Meter with the CT to VT links disconnected by removing screws.

Config Jumper

The *Config* jumper offers a level of hardware security to the meter – the jumper needs to be fitted to allow calibration and recovery of lost passwords. The jumper is located under the meter lid, half way along the top of the meter above the LCD (Figure 3-13). A jumper is fitted across the set of pins marked *Config*. The other set of pins marked *FTest* are for factory use only.
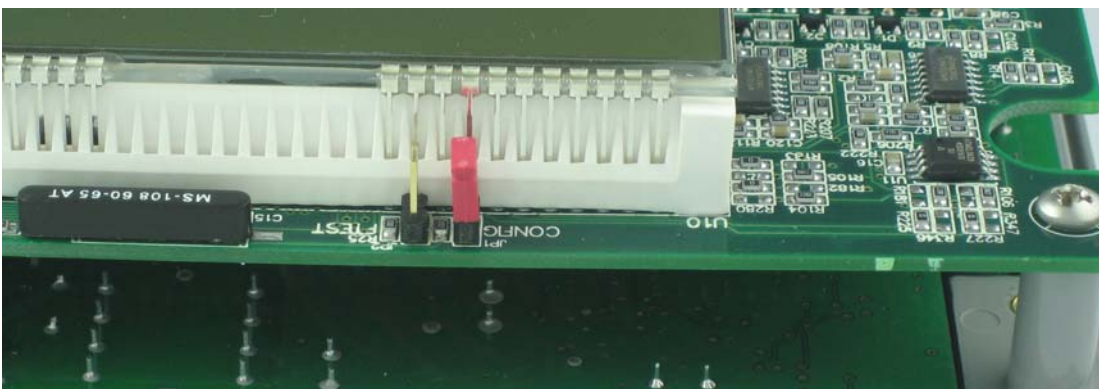
- Figure 3-13 Location of the *Config* jumper

Connections in Detail

Current and Voltage
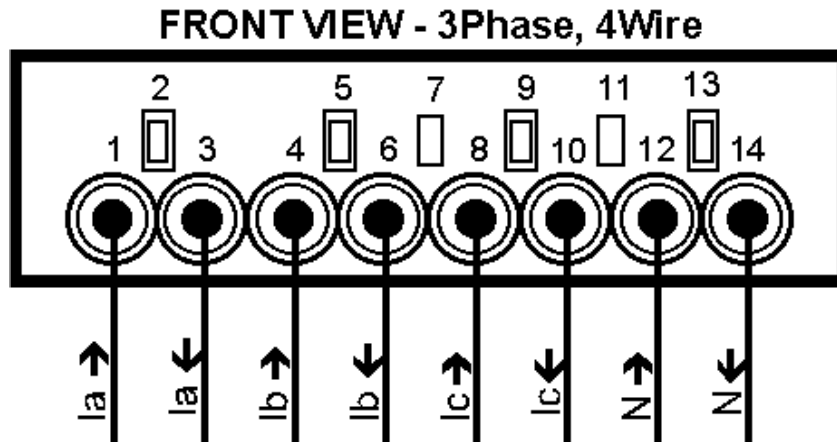
- Figure 3-14 Connections for 3 element whole current

Figure 3-14 shows the normal connections for a whole current meter (the meter is only available in a whole current configuration). The neutral connection must be made, even if it is not connected to both 12 and 14. The VT/CT links connect TB1 terminals 1 to 2, 4 to 5, 8 to 9, and 12 to 13 to 14. The links are fitted under the main meter cover, discussed earlier in this chapter.

The nominal voltage input range is 220 - 240 VAC. The absolute limits are 180VAC to 290VAC. The current range depends on the current range of the meter, and should be limited to Imax (at present normally 100A).

In 3 element mode (4 wire) the maximum line to neutral voltage is 290V and the maximum line to line voltage is 500V. At any higher voltage the meter may not operate correctly and damage may occur.
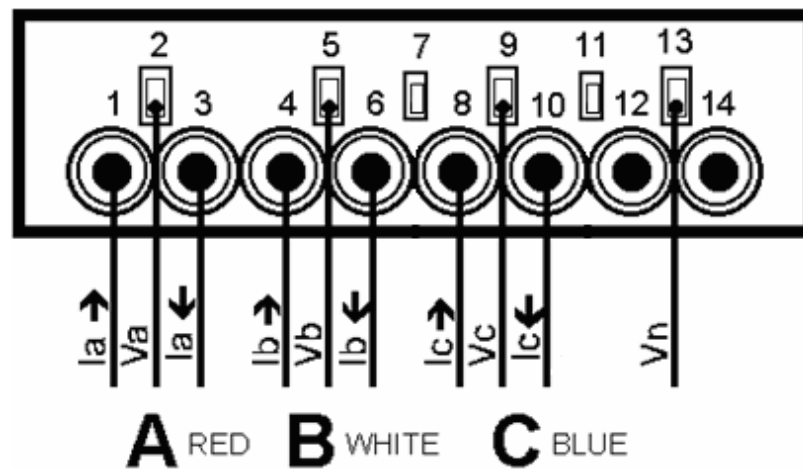
- Figure 3-15 TB1 CT and VT connections for 3 element testing

Figure 3-15 shows the connection methods in 3 element (4 wire) mode when VT/CT links are not fitted.

Serial Port Configurations

The meter has an option of one or two RS-232 ports, which can be arranged in a number of configurations with an RS485 port. The two ports are called Modem and SCADA. The possible options are listed in Table 3-2, which lines up with the order code options.

Type	Modem Communications
0	None
1	RS232 with RJ45
2	RS485 (4-wire) with 2xRJ45
3	RS485 (4-wire) with Screw Terminals
4	RS485 (2-wire) with 2xRJ45
5	RS232 with RJ45 and Modem Power Supply
6	RS232 with RJ45 + SCADA Port on Pin 7 & 8
7	RS232 with RJ45 and Modem power supply + SCADA port on Pin 7 & 8
8	RS232 with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
9	RS232 with RJ45 and Modem power supply + SCADA port 2nd RJ45 Pin 5 & 6
D	RS485 (4-wire) with RJ45 + SCADA Port on Pin 1 & 2
E	RS485 (4-wire) with RJ45 and Modem power supply + SCADA port on Pin 1 and 2
F	RS485 (4-wire) with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
G	RS485 (4-wire) with RJ45 and Modem power supply + SCADA port on 2nd RJ45 Pin 5 & 6
H	RS485 (4-wire) with 2xRJ45 + SCADA Port on 1st RJ45 Pin 1 & 2
I	RS485 (4-wire) with 2xRJ45 and Modem power supply + SCADA port on 1st RJ45 Pin 1 & 2
J	RS485 (2-wire) with RJ45 + SCADA Port on Pin 1 & 2
K	RS485 (2-wire) with RJ45 and Modem power supply + SCADA port on Pin 1 and 2
L	RS485 (2-wire) with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
M	RS485 (2-wire) with RJ45 and Modem power supply + SCADA port on 2nd RJ45 Pin 5 & 6
N	RS485 (2-wire) with 2xRJ45 + SCADA Port on 1st RJ45 Pin 1 & 2
P	RS485 (2-wire) with 2xRJ45 and Modem power supply + SCADA port on 1st RJ45 Pin 1 & 2

- Table 3-2 Serial port options

Where only one RJ45 is fitted it is TB10 that is fitted. TB10 is the 1st RJ45 and TB9 is the 2nd RJ45. The SCADA port is always RS232 in these options.

The connection on the label is indicated using a range of symbols that explain what the connections are. For instance:

corresponds with a Type 7 port. There is only one RJ45 (TB10), it is a dual connector (2 serial ports on the one connector), power is supplied (⏻), and both ports are RS232 (the top port is the Modem port, the bottom is the SCADA port).

RS-232

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use a modem with an RJ45 connector, or use an RJ45 to DB9 connector adapter. RTS/CTS hardware handshaking is not supported.

See Table 3-3 for connection details of TB10. Pin 1 of the RJ45 is on the right hand side.

RS232D RJ45 From Meter	RS232C DB9 To Modem	RS232C DB9 To PC (Null)	Description	Full Name
TB10-1 *	(9)	(9)	+7	+7V,300mA output
TB10-2				Not Connected
TB10-3	4	1	DTR	Data Terminal Ready (from meter)
TB10-4	5	5	GND	Ground
TB10-5	2	3	RX	Receive Data (to meter)
TB10-6	3	2	TX	Transmit Data (from meter)
TB10-7			RX2	Receive Data–SCADA port
TB10-8			TX2	Transmit Data-SCADA port

- Table 3-3 RS-232 connections

* TB10-1 is connected to a +7V power source from the meter, which is designed to power an external GSM modem. Other options are also available, contact EDMI for more details.

See Figure 3-4 and Figure 3-5 for the location of the RJ45 connector. It is designated as TB10.

RX2 and TX2 are only present if the port is a dual RS232 port.

When the SCADA port is on TB9, the connections are as per Table 3-3 except that TB10-3, TB10-7, and TB10-8 are not connected.

RS-485

The RS-485 port on the meter has the factory option of either an RJ45, or a 5 way terminal block. Table 3-4 lists the connections. Pin 1 of the RJ45 is on the right hand side. Pin 1 of the terminal block is on the left hand side.

RJ45	Terminal Block	Description	Full Name
TB10-1		TX2	Transmit Data-SCADA port
TB10-2		RX2	Receive Data-SCADA port
TB10-3	1	TX+ (A)	Transmit +
TB10-4	5	GND	Ground
TB10-5*		+5	+5V,140mA output
TB10-6	2	TX- (B)	Transmit Data
TB10-7	4	RX- (B)	Receive -
TB10-8	3	RX+ (A)	Receive +

- Table 3-4 RS-485 connections

*TB10-5 is connected to a +7V power source from the meter.

To operate the meter in two wire mode, simply wire TX- to RX- and TX+ to RX+. These may be wired together as a factory fitted option.

Note that the 5-pin terminal block has a different pinout to the EDMI mk6 and mk3 meter RS485 ports.

See Figure 3-4 and Figure 3-5 for the location of the connector. The 5 way terminal block is fitted in the same place (instead of) the RJ45 shown.

RX2 and TX2 are only present if the port is a dual RS485/RS232 port, and in this case RX2 and TX2 are RS232 signals.

One fitment option is two RJ45's wired in parallel (TB9 and TB10) – this is useful for wiring a series of meters together using premade cables.

PLC

In a PLC meter communications are made via the power line, coupled to Phase A and Neutral.

FLAG Port

The meter can have either a Flag Port or an ANSI Port. Use a standard FLAG (IEC1107 physical standard) read head to connect the meter to a PC.

Note that it has occasionally been found that some FLAG heads need to be rotated 180 degrees for them to work. If you have problems try this.

ANSI Port

The meter can have either Flag Port of ANSI Port. Standard Flag and ANSI read heads should work with the meter. Please note that older EDMI ANSI read heads will not work with the meter. To use a smart read head that can automatically switch polarity, set the DTR line to be low – see *Configure* in the *Site Properties* section of the *EziView Basics* chapter in the Atlas Software Reference Manual.

Inputs

The inputs may either be active, or passive. Passive inputs are isolated from all other circuits, including the other inputs. There are a variety of input voltages that may be ordered with the meter, e.g. 12V and 240V. Under voltage will cause the input to trigger erratically or not at all, while over voltage will cause excessive heat dissipation and possible damage to the meter.

The rated voltage is the voltage that must be applied between the two terminals of the input. The inputs work with any polarity, and with AC or DC signals. There are a maximum of 4 inputs.

Active inputs are also available as a factory option. They use power from the serial port, and are thus not isolated from the serial port, or from each other. In this case simply shorting between the input terminals will cause the input to trigger. The maximum external impedance is 500 ohms. Note that power is drawn from the isolated serial port supply, and will the inputs will not work while the serial port is powered down to cycle power to a modem.

Outputs

There are several types of outputs available. All outputs are isolated from all other circuits, including other I/O.

The SØ outputs are designed to switch up to 24VDC and 24mA.

The relay outputs are rated to 2A, 240VAC with an inductive load, or 5A, 240VAC for the high current version. These outputs should not be used as pulsing outputs for transmitting energy pulses, as the output contacts are subject to contact bounce and are not rated for continuous switching.

The BOSFET outputs are rated up to 240V, 100mA. They may switch either AC or DC voltages, any polarity.

Battery

The battery is used to run the clock during loss of power. It also allows the meter LCD to be activated while main power is not available.

The meter comes with an optional internal battery. The internal battery is a 3.0V, 700mAh Lithium battery. There is no external battery option at this time.

If an internal battery is used, a jumper will be connected to JP3 to enable the battery – this jumper is under the meter cover, near the battery.

A low battery indicator is displayed on the LCD if the battery is not present or is depleted – the level this occurs at can be configured. The battery usage life is longer than 10 years on continuous backup with either of the 700mAh batteries at 25°C. In normal operation the battery should last for more than 10 years.

Since the battery is soldered to the meter it is not considered replaceable.

LCD/Select Button

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and 5 seven-segment digits to display description (Figure 3-16). It has arrows to indicate import and export for active and reactive energies, indicators for phase voltage, indicators for display sets A and B, battery indicator, connection type indicator for connection through local or remote port and units and multipliers.
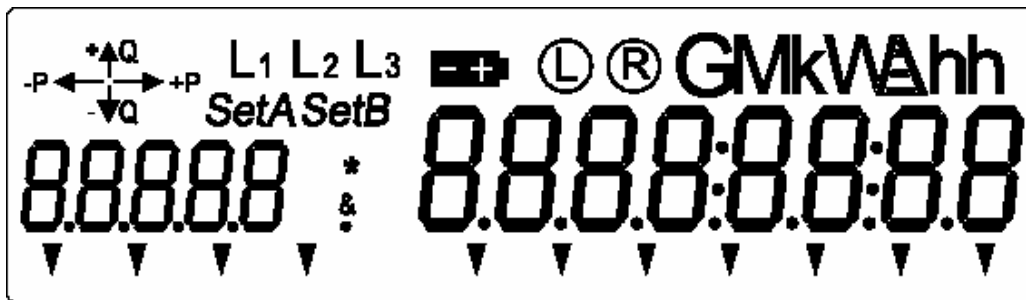
- Figure 3-16 LCD with all segments turned on

The LCD does not have a backlight. 2 description digits and 1 enunciator are not used, although they may be seen faintly on the display in some lighting conditions.

Early versions of the Mk10D had one less display description digit and decimal point, for a total of 4. This applies primarily to meters built before 2008.

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

For more detailed information on the LCD and *Select* button see Chapter 7: "LCD Display".

Reconnect/Boost/Billing Reset Button

The *Reconnect* button is the top of the two push buttons beside the display. The push button has a 2.5mm diameter hole through it, allowing it to be sealed using standard sealing wire. This button is usually used to connect the main contactor.

Holding the button down for at least half a second will connect the customers supply, if it is enabled for connection. The display will show "Connect". If it is not enabled, the display will show "not enabled" and the contactor state will not change.

Pushing both the *Select* button and the *Reconnect* button at the same time will cause the contactor to be disconnected. The message "Disconnect" will be displayed on the LCD.

The *Reconnect* button can also cause a boost operation for load control outputs, depending on configuration.

Note that the relay may not change state immediately. If another operation has just been performed, it may take 60 seconds to perform the requested operation.

EziView can configure what operations are permitted using the button. EziView can also be used to configure the button as a billing reset button - go to Security Setup and un-check the *Billing Reset Button Disabled* checkbox.

Servicing

The meter is not designed for field servicing and has no user serviceable parts. The meter has no internal fuses. In the event of failure of the meter, contact EDMI or your local agent for servicing.

Intentionally Left Blank

The Mk7A Meter

This chapter covers the basic installation and physical features of the Mk7A meter.

Dimensions and Mounting

Figure 4-1 shows the overall dimensions of the meter with a standard terminal cover.

Height

Depth

Width

- Figure 4-1 Overall dimensions of the meter

Height = 233 mm, Depth = 85 mm, Width = 128 mm

Figure 4-2 below gives more detailed dimensions for the meter.
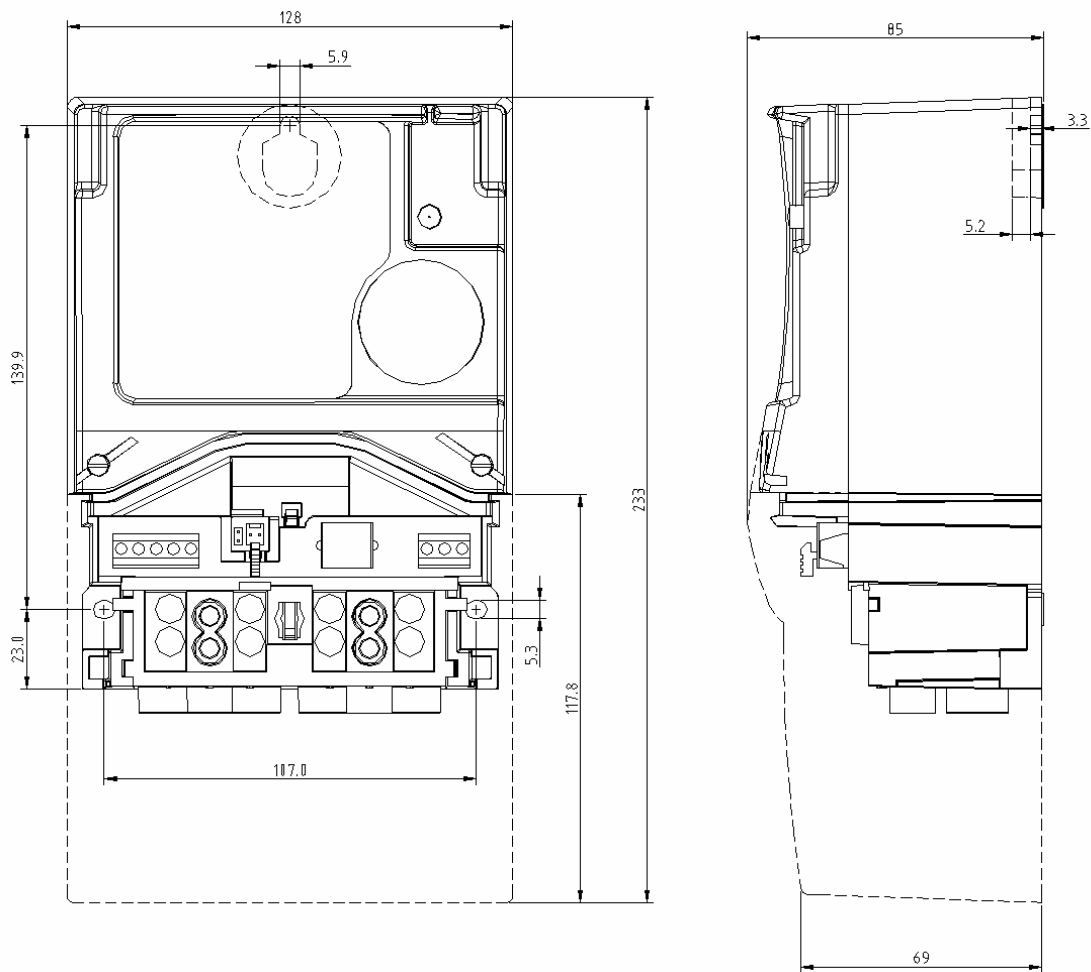
- Figure 4-2 Dimensions
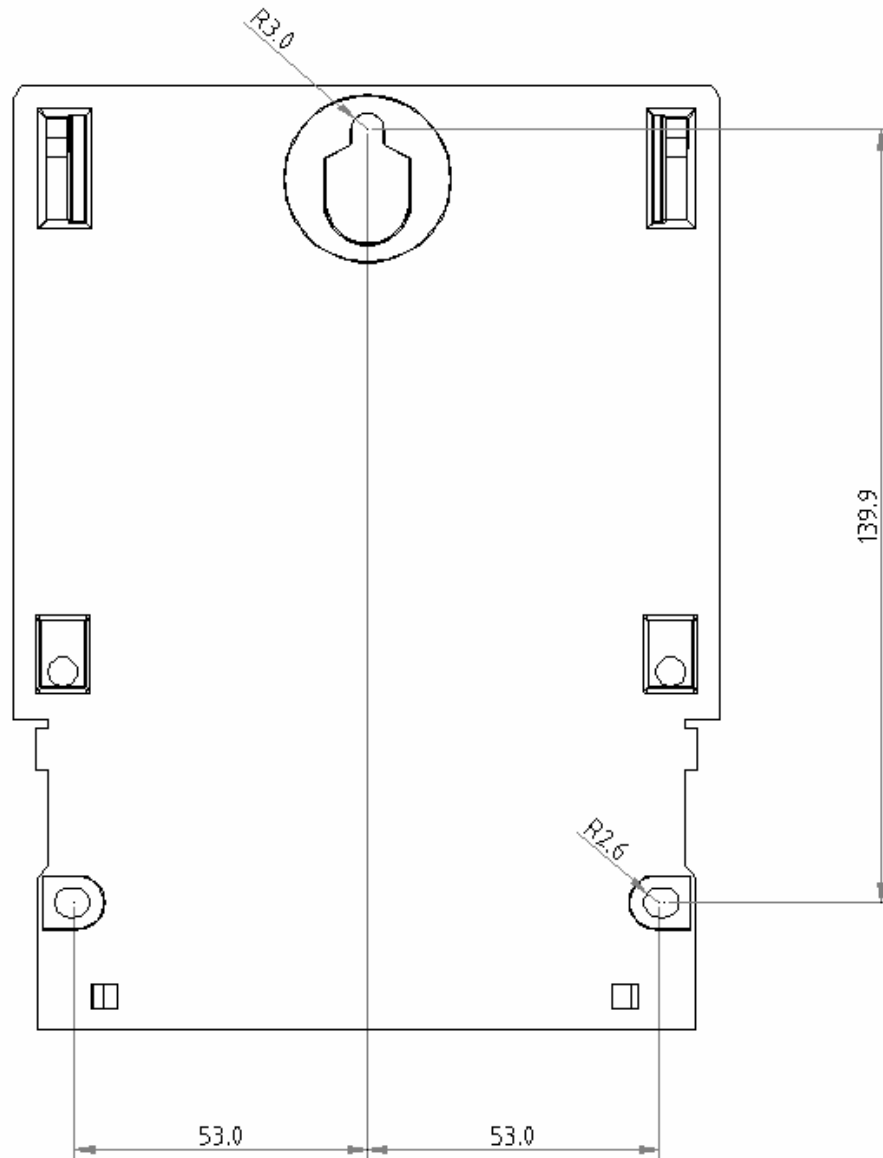
For mounting use 3 screws with a threaded section no larger than 5mm in diameter with a screw head no smaller than 8mm in diameter.

- Figure 4-3 Mounting points

The meter is mounted using three screws as shown in Figure 4-3. In general:

1. Screw the first (top) screw into the wall. Leave enough space between the head and the wall for the plastic around the keyhole.

2. Hang the meter on the screw using the keyhole in the back of the meter.

3. Insert the remaining two screws (meter base, under the terminal cover) to hold the meter securely.

External Features

Figure 4-4 shows a view of the front of the meter (the specifics of your label will vary).

- Figure 4-4 Front view of the meter with terminal cover fitted

The major parts visible in Figure 4-4 include:

- The LCD display.

- A *Select* button for cycling the display (push button just above the optical port).

- Two pulsing LEDs for energy indication (PO3 and PO4).

- A FLAG or ANSI port for local connection.

There is space for an optional Connect, Boost or Billing Reset button above the select button (See page 4-14).

Beneath the terminal cover (accessible by removing the sealable screw on the top middle of the terminal cover) is the terminal block for the supply and loads, connectors for the pulsing inputs and outputs (optional), the optional RS-232 or RS-485 interface, and the optional external battery

The sealable screws have 2.15mm diameter holes to accommodate standard sealing wire.

Under the Terminal Cover

Most of the connections to the meter occur under the terminal cover. Figure 4-5 shows the terminals available on a 2 input / 4 output / RS-232 meter.
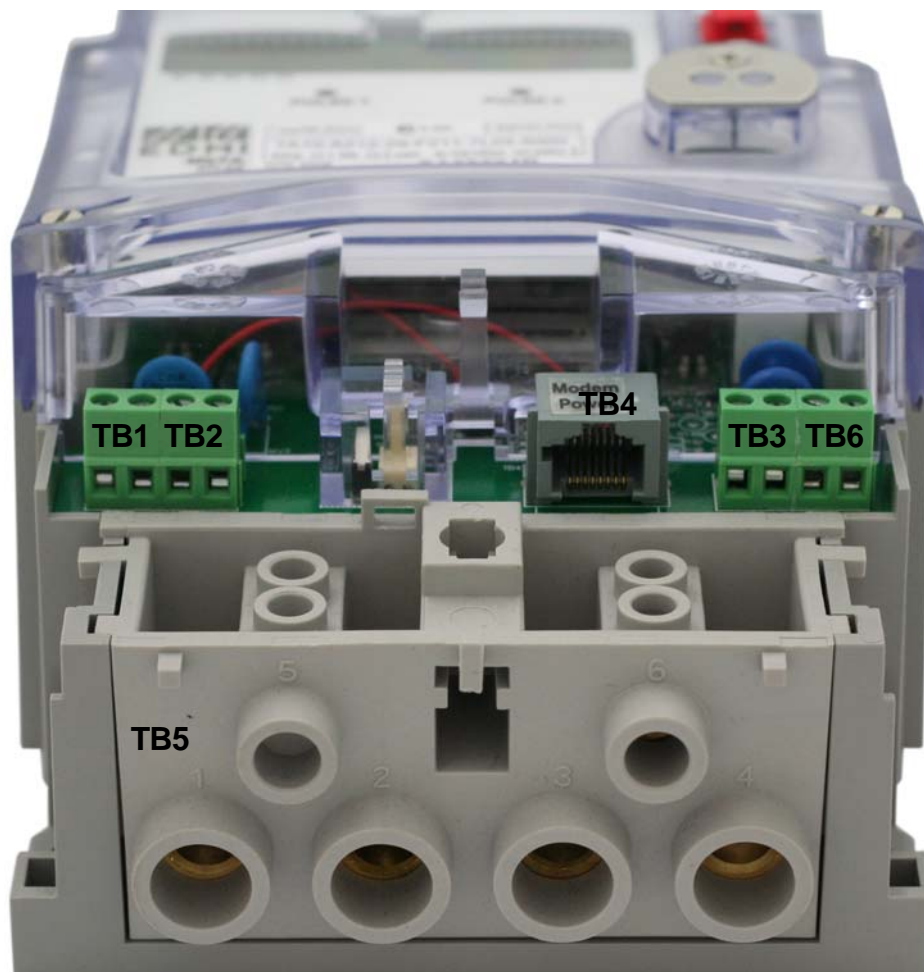
- Figure 4-5 Under the terminal cover of the meter

Diagrammatically, this is shown in Figure 4-6 with the terminal block numbering.
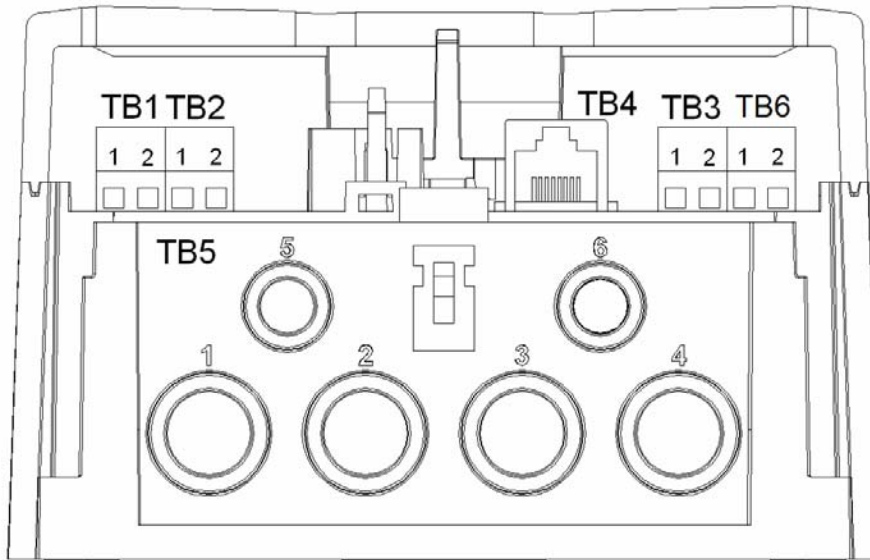
- Figure 4-6 Terminal block diagram

Table 4-1 lists the terminal block connections.

Terminal	Description
TB1	Input PI1 or output PO1
	SØ Output or 240V/110V/48V/12V/5V Input or Active Input
	TB1-1 Input /Output PI1 or PO1
	TB1-2 Common for Input/Output #1
TB2	Input PI1 & PI2
	SØ Output or 240V/110V/48V/12V/5V Input or Active Input
	TB2-1 Input /Output PI2 or PO2
	TB2-2 Common for Input/Output #2
TB3	Input PI5 & PI5
	SØ Output or 240V/110V/48V/12V/5V Input or Active Input or 2A,240V Relay or BOSFET output
	TB3-1 Input /Output PI5 or PO5
	TB3-2 Common for Input/Output #5
TB4	RJ45 connector which is factory fitted with 1 or 2 RS232 ports.
TB5	Voltage and current inputs.
	TB5-1 Incoming Active
	TB5-2 Incoming Neutral
	TB5-3 Outgoing Neutral
	TB5-4 Outgoing Active L1
	TB5-5 Additional Load #2 L3
	TB5-6 Additional Load #1 L2
TB6	Input PI6 & PI6
	SØ Output or 240V/110V/48V/12V/5V Input or Active Input or 2A,240V Relay or BOSFET output
	TB6-1 Input /Output PI6 or PO6
	TB6-2 Common for Input/Output #6

- Table 4-1 Terminal block connections

The isolation between TB1 and TB2 is minimal. There is also minimal isolation between TB3 and TB6. The isolation between these groups and line (neutral) and TB4 is 4kV.

Figure 4-7 gives the terminal spacing of TB5.
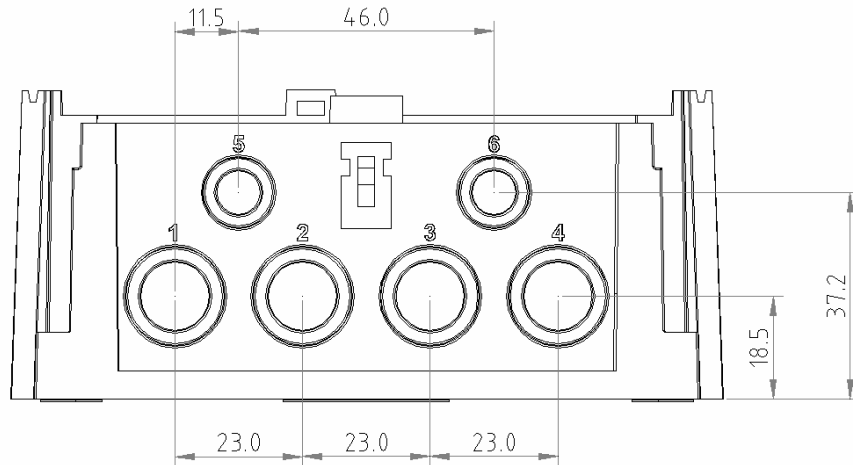
- Figure 4-7 TB5 terminal spacings

Table 4-2 gives the terminal inner dimensions.

Terminal	Profile	Dimensions
Main Circuit	Round	9.0 mm Ø
Load Circuit	Round	5.3 mm Ø

- Table 4-2 Terminal sizes

Finger Guard

A finger guard may be fitted over the TB5 terminal screws. This can help prevent accidental contact with the supply voltage, as well as allowing these connections to be sealed.
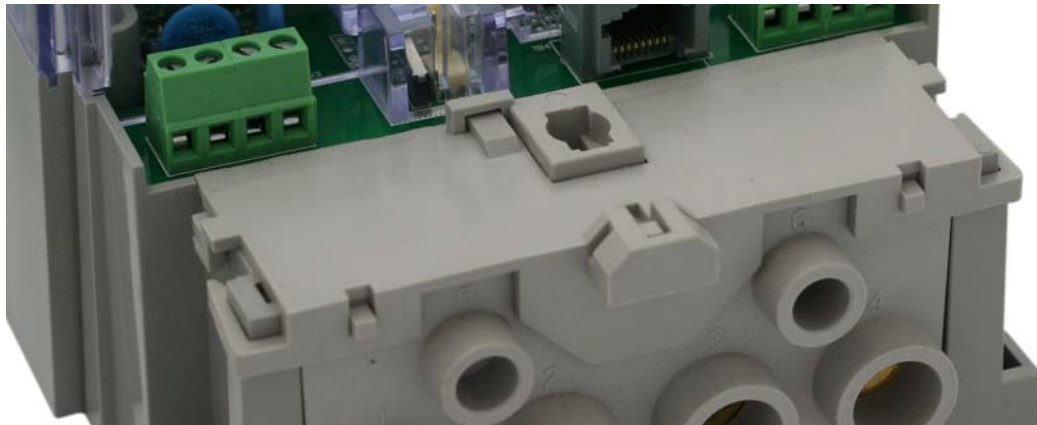
- Figure 4-8 The finger guard in place

Terminal Cover Tamper Detect

The meter has an optional switch that can detect the opening of the terminal cover. It is located above and to the left of the terminals (See Figure 4-9). The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the terminal cover. Alternatively it may be fitted to sense when the meter lid is opened, rather than the terminal cover.
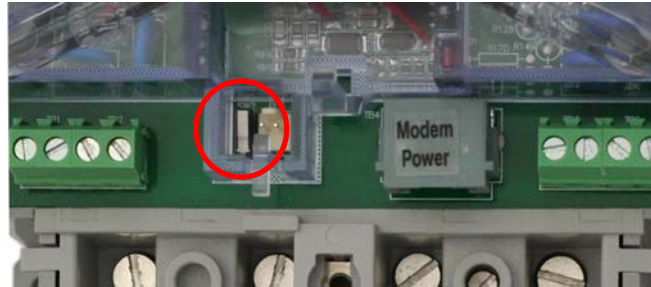
- Figure 4-9 The terminal cover tamper detect switch

Under the Meter Lid

Removing the two sealable screws allows the meter lid to be removed. Generally connections to the I/O connectors do not need to be detached to allow the cover to be removed. Removal of the meter lid is required to access the *Config Jumper*.

Care must be taken as dangerous voltages are present in the circuitry under the meter lid while the meter is active.
Even when the meter is not powered, care should be taken to prevent electrostatic damage to the circuitry of the meter.

CT to VT Links

The meter does not have removable CT to VT links. If testing the meter on a test bench, the test bench must be able to properly handle the permanent VT to CT connection.

Config Jumper

The *Config* jumper offers a level of hardware security to the meter – the jumper needs to be fitted to allow calibration and recovery of lost passwords. The jumper is located under the meter lid, half way up the far right side of the circuit board (Figure 4-10). A jumper is fitted across the bottom set of pins marked JP1 *Config*. The top set of pins marked JP2 *FTest* are for factory use only.
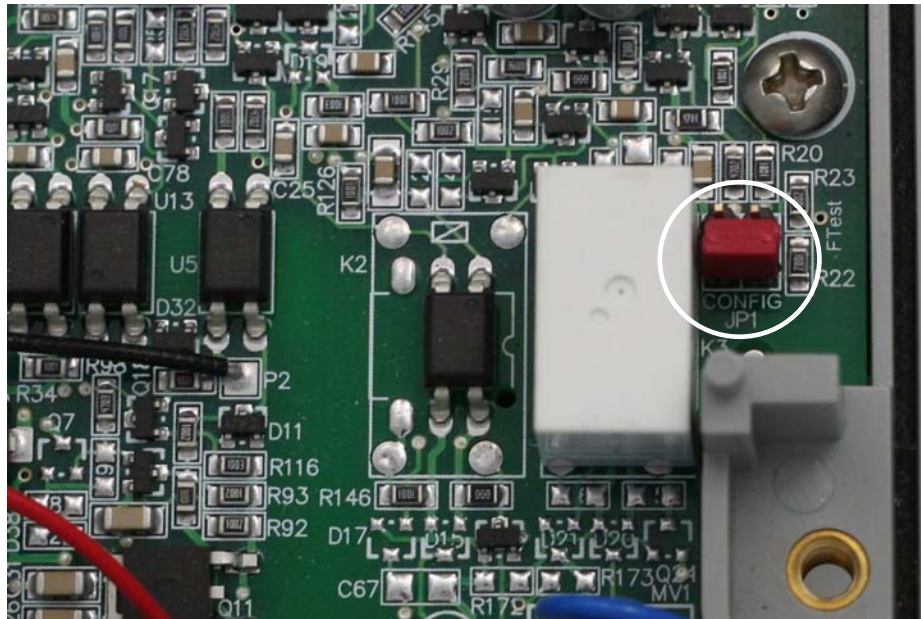
- Figure 4-10 Location of the *Config* jumper

Connections in Detail
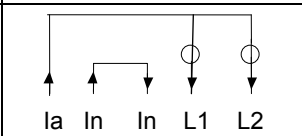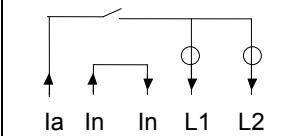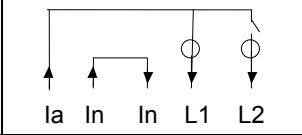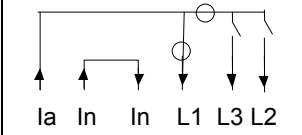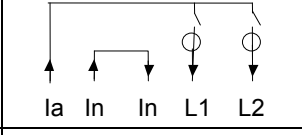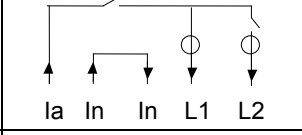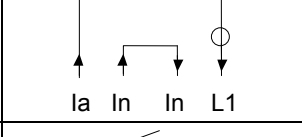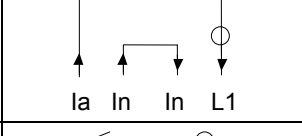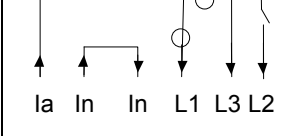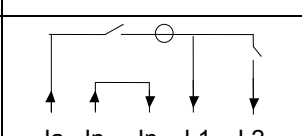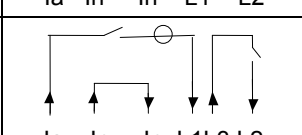
Current and Voltage
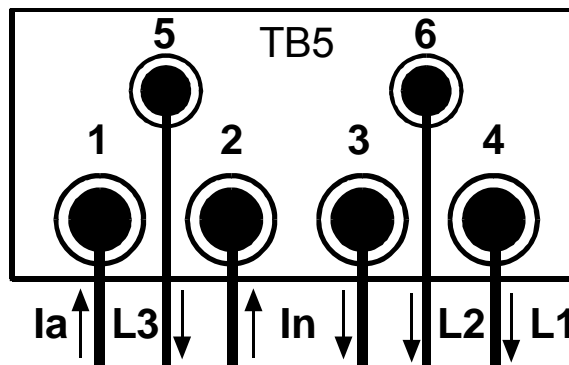
- Figure 4-11 TB5 Connections including a switched/metered load

Figure 2-18 shows the connection method with an extra load circuit L2. The nominal voltage input range is 220 - 240 VAC. The limit range of operation is 176VAC to 288VAC. The current range depends on the current range of the meter, and should be limited to Imax. The Load terminals TB5-5 and TB5-6 are limited to 60A. Note that there is no IEC standard for a 60A load control relay, so for type test approval 40A is stated.

There are a number of variations for the internal configuration of the meter, including internal contactors. Table 4-3 illustrates the options. In all cases **Ia** is the incoming current, and should be limited to 100A. **In** is the neutral connection, and should be limited to 100A.

Configuration	Diagram	Description
1	Ia In In L1 L2	2 Element L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A
2	Ia In In L1 L2	2 Element with 100A Main Disconnect L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A
3	Ia In In L1 L2	2 Element with 60A load control L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A
4	Ia In In L1 L3 L2	2 Element with 2x 60A load control outputs L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A L3 = Load Circuit Load 60A
5	Ia In In L1 L2	2 Element with 100A Disconnect and 60A load control L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A
6	Ia In In L1 L2	2 Element with 100A Main Disconnect and 60A load control L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A
7	Ia In In L1	1 Element L1 = Main Circuit Load 100A
8	Ia In In L1	1 Element with 100A Main Disconnect L1 = Main Circuit Load 100A
9	Ia In In L1 L3 L2	2 Element with 100A Main Disconnect and 60A load control + unswitched load L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A Switched L3 = Load Circuit Load 60A Unswitched
10	Ia In In L1 L2	1 Element with 100A Main Disconnect and 60A load control L1 = Main Circuit Load 100A L2 = Load Circuit Load 60A Switched
11	Ia In In L1 L3 L2	1 Element with 100A Main Disconnect and separate 60A load control L1 = Main Circuit Load 100A L2, L3 = Load Circuit Load 60A Switched

- Table 4-3 Configuration options

While the meter only has 1 measurement element for voltage, the meter has up to 3 measurement elements for current. The primary element I_1 is referred to as Main. The secondary element I_2 is referred to as Load. The third element measures the Neutral Current, and is referred to as Neutral. Total is the sum of Main and Load.

To compare with the Mk10, Main is Phase A, Load is Phase B, and Neutral current is Phase C – this may help in understanding the layout of some screens in EziView. While Total in the Mk10 is the sum of all three phases, Total in the Mk7 is the sum of the Main and Load elements only.

RS-232

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use an RJ45 to DB9 connector adapter.

Meters fitted with a passive serial port derive power from the signal lines of the modem. Thus the port cannot power an external modem. See Table 4-4 for connection details. Pin 1 of the RJ45 is furthest from the battery connector (i.e. on the right hand side).

RS232D RJ45 From Meter	RS232C DB9 To Modem	RS232C DB9 To PC (Null)	Description	Full Name
TB4-1 *	(9)	(9)	+15V	+15V,3.6W output
TB4-2				Not Connected
TB4-3				Not Connected
TB4-4	5	5	GND	Ground
TB4-5	2	3	RX	Receive Data (to meter)
TB4-6	3	2	TX	Transmit Data (from meter)
TB4-7			RX2	Receive Data–SCADA port
TB4-8			TX2	Transmit Data-SCADA port

- Table 4-4 RS-232 connections

* TB4-1 is connected to a +15V power source from the meter, which is designed to power an external GSM modem. Other options are also available, contact EDMI for more details. It may vary up to 20V with loading.

See Figure 4-5 and Figure 4-6 for the location of the RJ45 connector. It is designated as TB4.

RX2 and TX2 are only present if the port is a dual RS232 port. The Dual Port option supplies two serial ports on the one connector.

RS-485

There is no RS485 option at present.

FLAG Port

The meter can have either a Flag Port or an ANSI Port. Use a standard FLAG (IEC1107 physical standard) read head to connect the meter to a PC.

Note that it has occasionally been found that some FLAG heads need to be rotated 180 degrees for them to work. If you have problems try this.

ANSI Port

The meter can have either Flag Port of ANSI Port. Standard Flag and ANSI read heads should work with the meter. Please note that older EDMI ANSI read heads will not work with the meter. For smart read heads that can automatically switch polarity, set the DTR line to be low – see *Configure* in the *Site Properties* section of the *EziView Basics* chapter in the Atlas Software Reference Manual.

Inputs

The inputs may either be active, or passive. Passive inputs are isolated from all other circuits to 4kV, including the other inputs. The exception is the isolation to the adjacent I/O terminal which is minimal. There are a variety of input voltages that may be ordered with the meter, e.g. 12V and 240V. Under voltage will cause the input to trigger erratically or not at all, while over voltage will cause excessive heat dissipation and possible damage to the meter.

The rated voltage is the voltage that must be applied between the two terminals of the input. The inputs work with any polarity, and with AC or DC signals. There are a maximum of 4 inputs.

Active inputs are also available as a factory option. They use power from the serial port, and are thus not isolated from the serial port, or from each other. In this case simply shorting between the input terminals will cause the input to trigger. The maximum external impedance is 500 ohms. Note that power is drawn from the isolated serial port supply, but the inputs will still work while the serial port is powered down to cycle power to a modem.

Outputs

There are several types of outputs available. All outputs are isolated from all other circuits to 4kV, including other I/O. The exception is the isolation to the adjacent I/O terminal which is minimal.

The SØ outputs are designed to switch up to 24VDC and 24mA.

The relay outputs are rated to 2A, 240VAC with an inductive load. These outputs should not be used as pulsing outputs for transmitting energy pulses, as the output contacts are subject to contact bounce and are not rated for continuous switching.

The BOSFET outputs are rated up to 240V, 100mA. They may switch either AC or DC voltages, any polarity.

Battery

The battery is used to run the clock during loss of power. It also allows the meter LCD to be activated while main power is not available.

The meter comes with an optional internal or external battery. The external battery is a 3.0V, 700mAh Lithium battery. If a 3.6V external battery is used it will discharge

during normal operation – do not use a 3.6V battery. The Mk6 Genius uses a 3.6V battery. Figure 4-12 shows the fitting of the external battery.
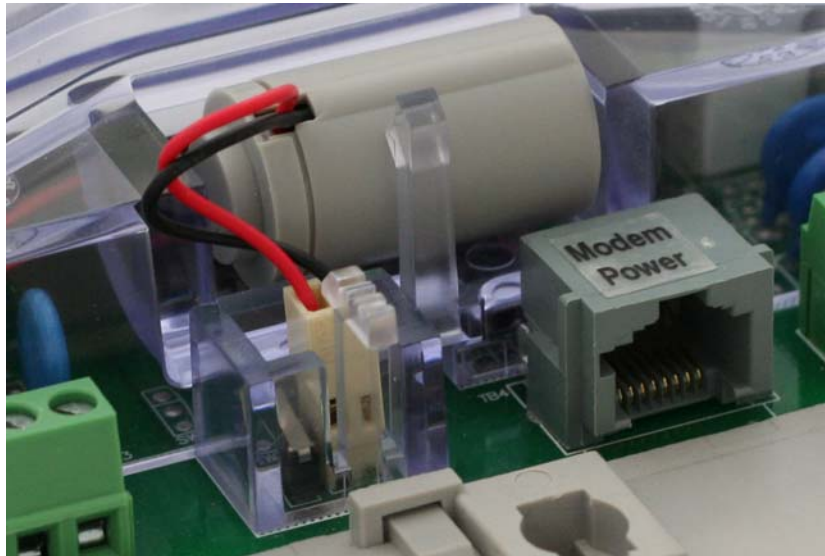
- Figure 4-12 Location of the external battery plugged into PL3

The internal battery is a 3.0V, 700mAh Lithium cell. Only one battery can be used at one time.

The jumper to enable the internal battery is inside the meter, located between the two buttons. To use an external battery plug the battery connector into PL3 (the internal battery jumper does not need to be removed). The external battery is clipped into the compartment above PL3.

Replacement batteries may be ordered from EDMI separately. A low battery indicator is displayed on the LCD if the battery is not present or is depleted – the level this occurs at can be configured. The battery usage life is longer than 10 years on continuous backup with either of the 700mAh batteries at 25°C. In normal operation the battery should last for more than 10 years.

To eliminate the possibility of data loss it is best to change the battery while the meter is running. Care must be taken as the battery is at the potential of the neutral terminal.

The battery is at the potential of the neutral terminal. If conditions (such as wiring configuration) make this a dangerous operation then steps should be taken to ensure that it is safe to do so. While the risk of coming into contact with the conductors during a battery change is minimal, care must be exercised.

LCD/Select Button

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and 4 seven-segment digits to display description (Figure 4-13). It has arrows to indicate import and export for active and reactive energies, indicators for display sets A and B, battery indicator, currency

indicator, connection type indicator for connection through local or remote port and units and multipliers. The LCD does not have a backlight
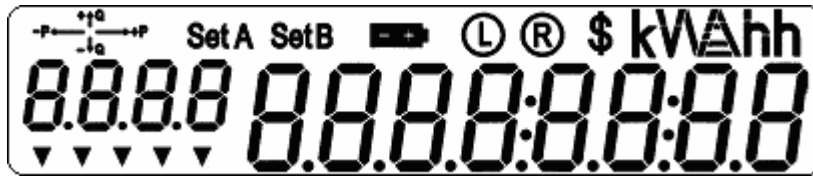
- Figure 4-13 LCD with all segments turned on

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

For more detailed information on the LCD and *Select* button see Chapter 7: "LCD Display".

Reconnect/Boost or Billing Reset Button

An optional *Reconnect, Boost*, or *Billing Reset* button may be fitted above the select button (See Figure 4-14). The push button has a 2.5mm diameter hole through it, allowing it to be sealed using standard sealing wire.

- Figure 4-14 Location of the *Billing Reset* / *Boost* button

When used as a *Reconnect* button, holding the button down for at least half a second will connect the customers supply, if it is enabled for connection. The display will show "Connect". If it is not enabled, the display will show "not enabled" and the contactor state will not change.

Pushing both the *Select* button and the *Reconnect* button at the same time will cause the contactor to be disconnected. The message "Disconnect" will be displayed on the LCD.

The *Reconnect* button can also cause a boost operation for load control outputs, depending on configuration.

Note that the relay may not change state immediately. If another operation has just been performed, it may take 60 seconds to perform the requested operation.

EziView can configure what operations are permitted using the button. EziView can also be used to configure the button as a billing reset button - go to Security Setup and un-check the *Billing Reset Button Disabled* checkbox.

Servicing

The meter is not designed for field servicing and has no user serviceable parts. The meter has no internal fuses. In the event of failure of the meter, contact EDMI or your local agent for servicing.

Intentionally Left Blank

The Mk7C Meter

This chapter covers the basic installation and physical features of the Mk7C meter.

Dimensions and Mounting

Figure 5-1 shows the overall dimensions of the meter with a standard terminal cover.

Width

Depth

Height

- Figure 5-1 Overall dimensions of the meter

Height = 163.5 mm, Depth = 51 mm, Width = 134 mm

Figure 5-2 below gives more detailed dimensions for the meter. Figure 5-3 gives the dimensions of the meter with a modem terminal cover fitted, which can house a GSM modem.
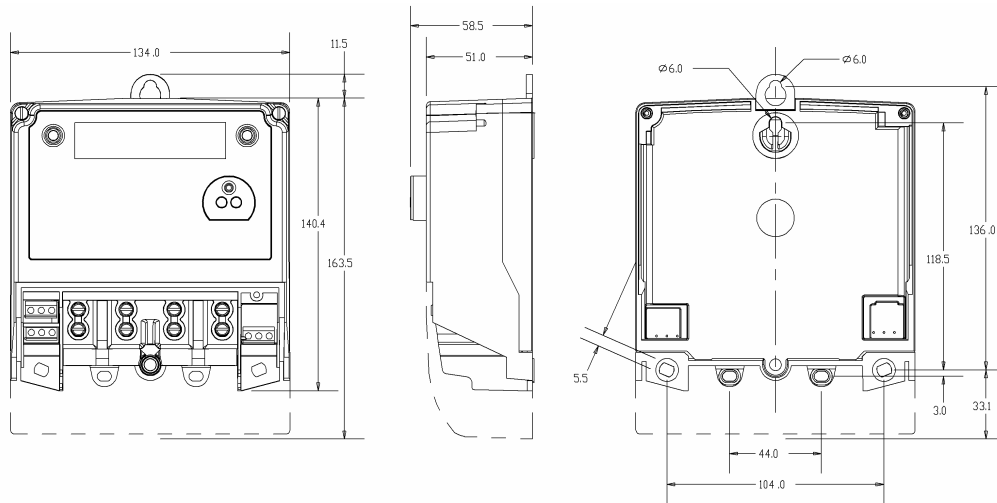
- Figure 5-2 Dimensions with standard terminal cover
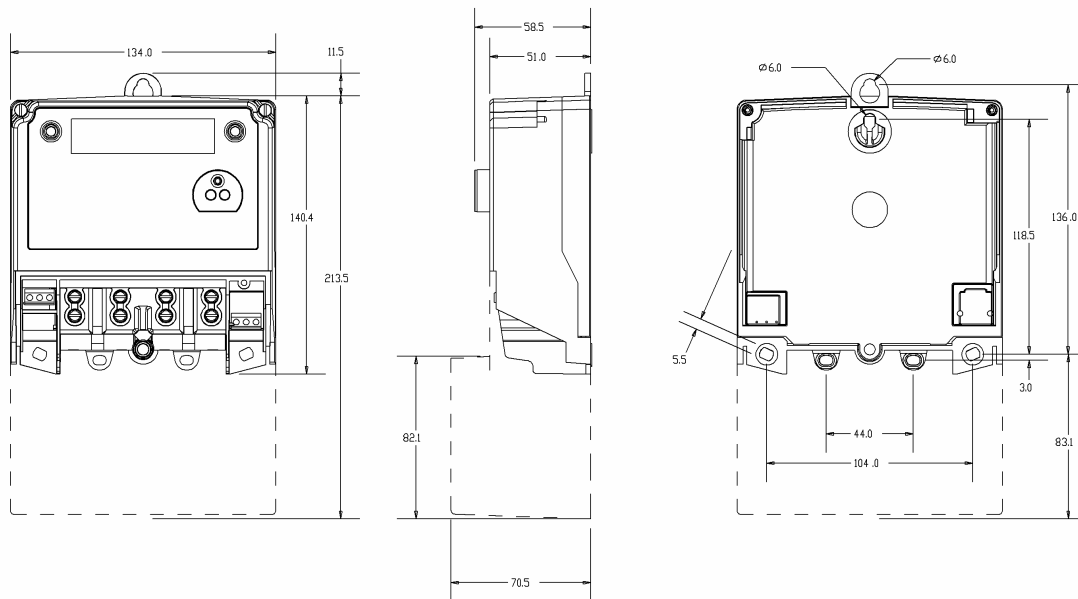
- Figure 5-3 Dimensions with modem terminal cover
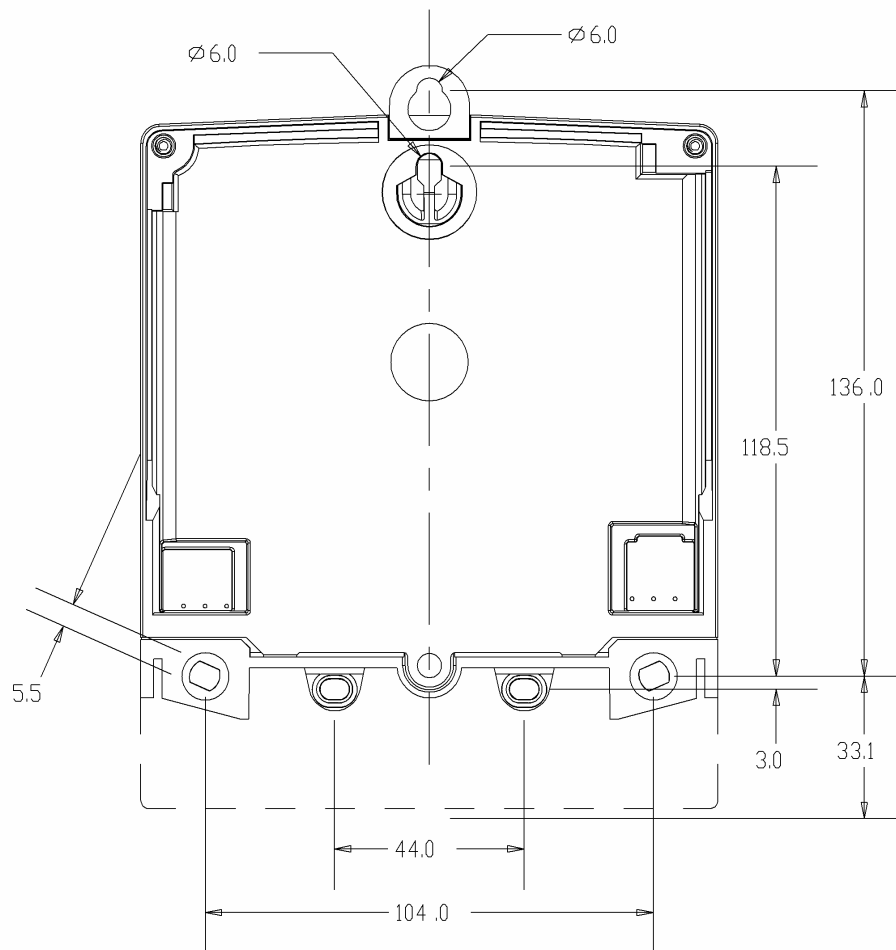
For mounting use 3 screws with a threaded section no larger than 5mm in diameter with a screw head no smaller than 8mm in diameter.

- Figure 5-4 Mounting points

The meter is mounted using three screws as shown in Figure 5-4. In general:

4. Screw the first (top) screw into the wall. Leave enough space between the head and the wall for the plastic around the keyhole.

5. Hang the meter on the screw using the keyhole in the back of the meter.

6. Insert the remaining two screws (meter base, under the terminal cover) to hold the meter securely. There are two choices for these screws – the inner set of holes can be used if the meter needs to be mounted to existing holes.

Hanging Extension

The top mounting hole can be extended using a clip in extension, as shown in Figure 5-5 and Figure 5-6. This allows a screw to be inserted after the meter is placed on the wall. This does however make the meter slightly taller (11.5 mm), and allows the screw to be removed without removing the terminal cover and removing the other two screws first.

The clip can be easily removed with access to the back of the meter by pushing the centre part in and sliding the clip out.

- Figure 5-5 The hanger extension clip

- Figure 5-6 Hanging keyhole with the clip fitted

External Features

Figure 5-7 shows a view of the front of the meter (the specifics of your label will vary).

- Figure 5-7 Front view of the meter with terminal cover fitted

The major parts visible in Figure 5-7 include:

- The LCD display

- A *Select* button for cycling the display (push button in the top right)

- Two pulsing LEDs for energy indication, independent of the I/O. (PO3 and PO4)

- A FLAG/IEC or ANSI port for local connection (FLAG/IEC on this meter)

- A *Connect* button positioned in the top left (See page 5-17)

Beneath the terminal cover (accessible by removing the sealable screw on the top middle of the terminal cover) is the terminal block for the supply and loads, connectors for the pulsing inputs and outputs (optional), and the optional RS-232 or RS-485 interface.

The sealable screws have 2.15mm diameter holes to accommodate standard sealing wire. The two sealable screws at the top of the meter seal the internals of the meter.

Under the Terminal Cover

Most of the connections to the meter occur under the terminal cover. Figure 5-8 shows the terminals available on a PLC meter with 4 I/O.

- Figure 5-8 Under the terminal cover of the meter

The meter has several communications options, which affect the range of other options available. The *Order Code* is the digit from the 'Remote Communications' section of the Mk7C order codes.

Model	Order Code	Description
Basic	0	No communications besides the optical port.
Passive	1,3,7	Passive RS232 / RS485 ports. This is a low power design which limits some options such as relay outputs. It cannot have active inputs.
Active	2,5,6	Active RS232 / RS485 ports. This has a powerful isolated supply to run the communication ports, and external GSM/GPRS modem, and active inputs.
Active Dual	9	2 Active RS232 ports. This has a powerful isolated supply to run the communication ports, and external GSM/GPRS modem, and active inputs.
PLC	A,C	PLC. This has an internal PLC communications interface, but no RS232 or RS485 port.

- Table 5-1 Meter options

Figure 5-9 illustrates the terminal layout diagrammatically, and Figure 5-10 gives the details of the terminal itself.
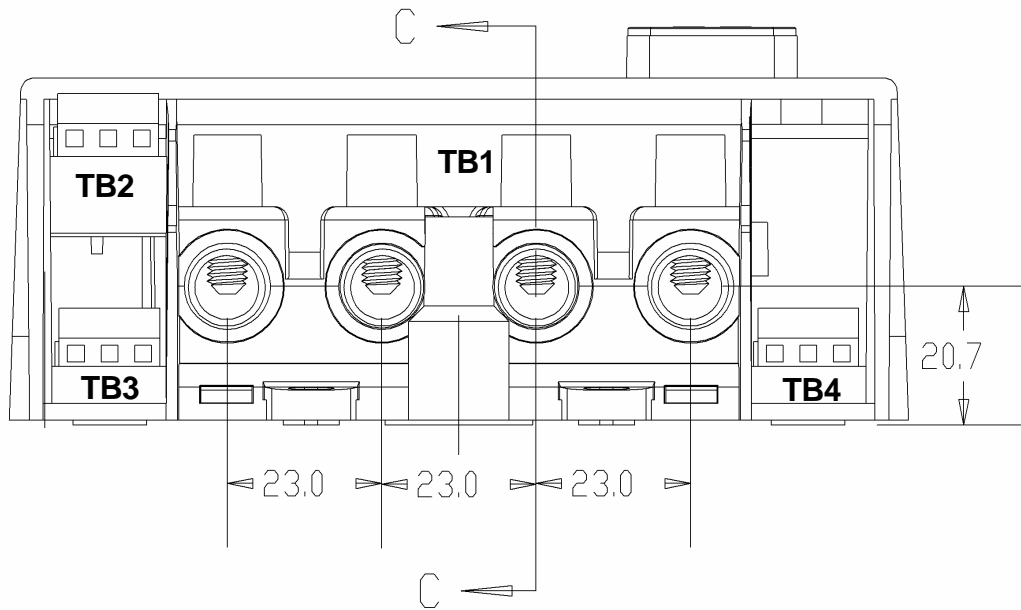
- Figure 5-9 Terminal block diagram

.
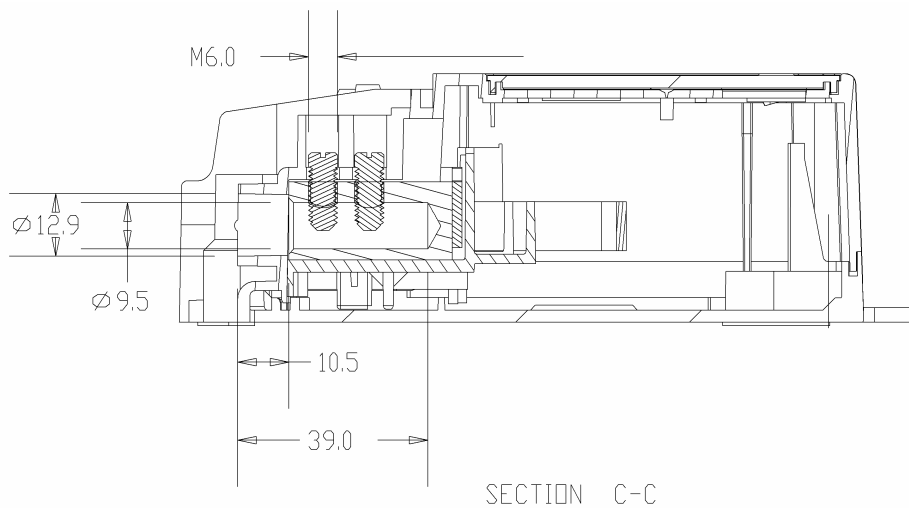
- Figure 5-10 TB1 terminal details

Table 5-2 to Table 5-7 list the terminal block connections for the various configurations. All terminals numbered left to right.

Terminal	Description
TB1	Voltage and current inputs.
	TB1-1 Incoming Active
	TB1-2 Incoming Neutral
	TB1-3 Outgoing Neutral
	TB1-4 Outgoing Active L1

- Table 5-2 Terminal block connections - Common

Terminal	Description
TB2	TB2-1 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-2 PI2/PO2 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-3 Common for PI1/PO1 and PI2/PO2
TB3	Nothing Fitted
TB4	RS232 or RS485 - RJ45 connector
	RS485 - 4 way terminal block
	TB4-1 Power Top left terminal
	TB4-2 TX+/RX+ Bottom left terminal
	TB4-3 Ground Top right terminal
	TB4-4 TX-/RX- Bottom right terminal

- Table 5-3 Terminal block connections - Passive

Terminal	Description
TB2	TB2-1 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-2 PI2/PO2 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-3 Common for PI1/PO1 and PI2/PO2
	One or both inputs may be an active input. Note that active inputs on TB4 is the preferred construction for active inputs.
TB3	RS232 – RJ45
	RS485 – RJ45 4 wire
	RS485 – 2 way terminal block
	TB3-1 TX+/RX+
	TB3-2 TX-/RX-
TB4	TB4-1 PI5/PO5 SØ Output or 12V/5V Input or Active Input
	TB4-2 PI6/PO6 SØ Output or 12V/5V Input or Active Input
	TB4-3 Common for PI5/PO5 and PI6/PO6

- Table 5-4 Terminal block connections - Active without relay

Terminal	Description
TB2	TB2-1 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-2 PI2/PO2 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-3 Common for PI1/PO1 and PI2/PO2
	One or both inputs may be an active input.
TB3	RS232 – RJ45
	RS485 – RJ45 4 wire
	RS485 – 2 way terminal block
	TB3-1 TX+/RX+
	TB3-2 TX-/RX-
TB4	TB4-1 PO6 240V, 2A Relay output
	TB4-2 Common for PO6

- Table 5-5 Terminal block connections - Active with relay

Terminal	Description
TB2	TB2-1 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-2 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-3 Common for PI1/PO1 and PI2/PO2
TB3	TB3-1 PI5/PO5 SØ Output or 240V/110V/48V/12V/5V Input
	TB3-2 PI6/PO6 SØ Output or 240V/110V/48V/12V/5V Input
	TB3-3 Common for PI5/PO5 and PI6/PO6
TB4	Nothing Fitted

- Table 5-6 Terminal block connections - PLC no relay

Terminal	Description
TB2	TB2-1 PI1/PO1 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-2 PI2/PO2 SØ Output or 240V/110V/48V/12V/5V Input
	TB2-3 Common for PI1/PO1 and PI2/PO2
TB3	TB3-2 PI6/PO6 SØ Output or 240V/110V/48V/12V/5V Input
	TB3-3 Common for PI6/PO6
TB4	TB4-1 PO5 240V, 2A Relay output
	TB4-2 Common for PO5

- Table 5-7 Terminal block connections - PLC with relay

Finger Guard

A finger guard may be fitted over the TB1 terminal screws. This can help prevent accidental contact with the supply voltage.

- Figure 5-11 The finger guard in place

Terminal Cover Tamper Detect

The meter has an optional switch that can detect the opening of the terminal cover. It is located above and to the left of the terminals (See Figure 5-12). The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the terminal cover.

- Figure 5-12 The terminal cover tamper detect button

Inside the Meter

Removing the two sealable screws at the top of the meter allows the meter back cover to be removed, which swings away from the back of the meter. Generally connections to the meter do not need to be detached to allow the cover to be removed, but the meter cannot be mounted on a surface, and the terminal cover must be removed. Removal of the back cover is required to access the *Config Jumper*.

Care must be taken as dangerous voltages are present in the circuitry inside the meter while the meter is active.
Even when the meter is not powered, care should be taken to prevent electrostatic damage to the circuitry of the meter.

CT to VT Links

The meter does not have removable CT to VT links. If testing the meter on a test bench, the test bench must be able to properly handle the permanent VT to CT connection.

Config Jumper

The *Config* jumper offers a level of hardware security to the meter – the jumper needs to be fitted to allow calibration and recovery of lost passwords. In the Mk7C the jumper is not permanently fitted. A connection must be made on the circuit board to enable the

Config mode. The connection location is under the meter lid, in the middle near the top of the meter (Figure 5-13). A connection must be made between the two indicated circuit board pads for at least 1 second.

This can be done while the meter is on, but is not recommended due to the difficulty in accessing it safely. The connection can also be made while the meter is turned off, by first 'waking up' the LCD by pushing the select button (this mode of operation must be enabled). The connection can be made using any implement that will connect the two points together electrically, such as a screwdriver or small pair of pliers. It should take about 2 seconds to register.
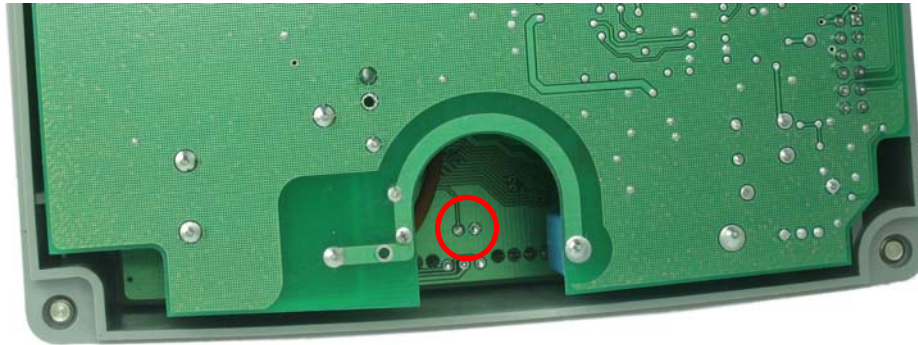
- Figure 5-13 Location of the *Config* "jumper"

To help determine the state of the jumper, there is a special LCD screen to show the state. Press and hold the *Select* button for 20 seconds – the screen should change to display the serial number, and both *Set A* and *Set B* will be displayed. Press the Select button until the 'Jump' screen is shown – it should take 7 presses. When this screen shows a number 127 or less the jumper is not connected – the meter is secure. When it shows a number 128 or above the jumper is connected.

Connections in Detail

Current and Voltage
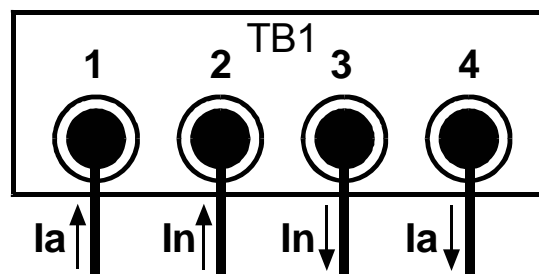
- Figure 5-14 TB1 Connections

Figure 5-14 shows the connection method. The nominal voltage input range is 220 - 240 VAC. The limit range of operation is 195VAC to 275VAC. The current range depends on the current range of the meter, and should be limited to Imax.

The meter may be fitted with an internal 100A disconnect relay, which interrupts the active connection. Figure 5-15 illustrates the disconnect and non-disconnect options.
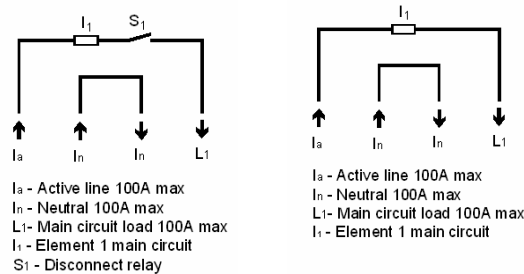
- Figure 5-15 Internal connection options

While the meter only has 1 measurement element for voltage, the meter has up to 2 measurement elements for current. The primary element I_1 is referred to as Main. The other (optional) element measures the Neutral Current, and is referred to as Neutral. Total is the same as Main. The Mk7C does not have a Load circuit like the Mk7A has.

To compare with the Mk10, Main is Phase A and Neutral is Phase C. While Total in the Mk10 is the sum of all three phases, Total in the Mk7C is the Main element only.

RS-232 Passive

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use a modem with an RJ45 connector or use an RJ45 to DB9 adapter.

Meters fitted with a passive serial port derive power from the signal lines of the modem. Thus the port cannot power an external modem. See Table 5-8 for connection details. Pin 1 of the RJ45 is furthest on the right hand side.

RS232D RJ45 From Meter	RS232C DB9 To Modem	Description	Full Name
TB4-1			
TB4-2	1	CD	Carrier Detect (to meter)
TB4-3			
TB4-4	5	GND	Ground
TB4-5	2	RX	Receive Data (to meter)
TB4-6	3	TX	Transmit Data (from meter)
TB4-7	7	CTS	Clear to Send (to meter)
TB4-8	8	RTS	Ready to Send (from meter)

- Table 5-8 RS-232 connections

The RTS and CTS hardware handshaking lines are looped back within the meter, but they are not driven or detected by the meter. The meter draws power from the CD and/or CTS lines, so a least one of these lines should be always driven high by the modem. The meter does not sense the state of the CD line.

A minimal modem connection is thus GND, RX, TX, and either CD, or RTS and CTS. Connecting RTS/CTS can help with modems that have hardware flow control turned on by default. Preferably both CD and RTS/CTS should be connected.

See Figure 5-8 and Figure 5-9 for the location of the RJ45 connector. It is designated as TB4.

RS-232 Active

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use a modem with an RJ45 connector, or use an RJ45 to DB9 adapter. RTS/CTS hardware handshaking is not supported. See Table 5-9 for connection details. Pin 1 of the RJ45 is on the right hand side.

RS232D RJ45 From Meter	RS232C DB9 To Modem	RS232C DB9 To PC (Null)	Description	Full Name
TB3-1 *	(9)	(9)	+12	+12V,3.6W output
TB3-2				Not Connected
TB3-3				Not Connected
TB3-4	5	5	GND	Ground
TB3-5	2	3	RX	Receive Data (to meter)
TB3-6	3	2	TX	Transmit Data (from meter)
TB3-7			RX2	Receive Data–SCADA port
TB3-8			TX2	Transmit Data-SCADA port

- Table 5-9 RS-232 connections

* TB3-1 is connected to a +12V power source from the meter. This voltage is enough for PSTN, GSM, and GPRS modems. It may vary up to 20V with loading.

See Figure 5-8 and Figure 5-9 for the location of the RJ45 connector. It is designated as TB3.

TB3-7 and TB3-8 are present when a 3rd serial port option (SCADA port) is fitted to the meter.

RS-485 Passive

The RS-485 port on the meter has the factory option of either an RJ45, or a 4 way terminal block. Table 5-10 lists the connections. Pin 1 of the RJ45 is on the right hand side. Pin 1 of the terminal block is on the left hand side.

RJ45	Terminal Block	Description	Full Name
TB4-3	TB4-2	TX+ (A)	Transmit +
TB4-6	TB4-4	TX- (B)	Transmit -
TB4-8	TB4-2	RX+ (A)	Receive +
TB4-7	TB4-4	RX- (B)	Receive -
TB4-4	TB4-3	GND	Ground
TB4-5*	TB4-1*	+8V to +15V	Port supply
TB4-1			Not Connected
TB4-2			Not Connected

- Table 5-10 RS-485 connections

*This terminal must be connected to an external power supply in the range of +8V to +15V, with a capacity to supply 100mA (this is to deal with a shorted bus - normal operating current is far lower).

Transmit refers to transmitting data from the meter. When a terminal block is used the port operates in 2 wire mode. When an RJ45 is used the port operates in 4 wire mode. To operate the meter in two wire mode, simply wire TX- to RX- and TX+ to RX+.

See Figure 5-8 and Figure 5-9 for the location of the connector, designated as TB4.

RS-485 Active

The RS-485 port on the meter has the factory option of either an RJ45, or a 2 way terminal block. Table 5-11 lists the connections. Pin 1 of the RJ45 is on the right hand side). Pin 1 of the terminal block is on the left hand side.

RJ45	Terminal Block	Description	Full Name
TB3-1		TX2	Transmit Data–SCADA port
TB3-2		RX2	Receive Data-SCADA port
TB3-3	TB3-1	TX+ (A)	Transmit +
TB3-4		GND	Ground
TB3-5*		+12	+12V,200mA output
TB3-6	TB3-2	TX- (B)	Transmit Data
TB3-7	TB3-2	RX- (B)	Receive -
TB3-8	TB3-1	RX+ (A)	Receive +

- Table 5-11 RS-485 connections

* TB3-5 is connected to a +12V power source from the meter. This voltage is enough for PSTN, GSM, and GPRS modems.

Transmit refers to transmitting data from the meter. When a terminal block is used the port operates in 2 wire mode. When an RJ45 is used the port operates in 4 wire mode. To operate the meter in two wire mode, simply wire TX- to RX- and TX+ to RX+.

See Figure 5-8 and Figure 5-9 for the location of the connector, designated as TB3.

TB3-1 and TB3-2 are present when a 3rd serial port option (SCADA port) is fitted to the meter. They are RS232 signals.

FLAG Port

The meter can have either a Flag Port or an ANSI Port. Use a standard FLAG (IEC1107 physical standard) read head to connect the meter to a PC.

Note that it has occasionally been found that some FLAG heads need to be rotated 180 degrees for them to work. If you have problems try this.

ANSI Port

The meter can have either Flag Port of ANSI Port. Standard Flag and ANSI read heads should work with the meter. Please note that older EDMI ANSI read heads will not work with the meter. To use smart read heads that can automatically switch polarity, set the DTR line to be low – see *Configure* in the *Site Properties* section of the *EziView Basics* chapter in the Atlas Software Reference Manual.

Inputs

The meter may be fitted with up to 4 inputs, depending on configuration. There are two main types of inputs available, and a mix of these types may be fitted. Many of the configurations make use of a common terminal to allow for more I/O in the limited space available.

Passive inputs require an external voltage to activate them. They are isolated to 4kV from all other circuits except the other inputs and outputs on the same terminal block. There are a variety of input voltages that may be ordered with the meter, e.g. 24V, 240V, though higher voltages (>40V) are not available in some combinations and terminal locations. Under voltage will cause the input to trigger erratically or not at all, while over voltage will cause excessive heat dissipation and possible damage to the meter. The rated voltage is the voltage that must be applied between the two terminals of the input. The inputs work with any polarity, and with AC or DC signals.

Active inputs use a 12V supply from the active RS232 and RS485 versions of the meter to create active inputs. The power to the input is maintained even if the modem is power cycled by the meter. A load of 500 Ω or less across the input terminals will activate the input. Note that active inputs are not isolated from each other, and are not isolated from the RS232/RS485 port (they share a ground).

For the locations of the inputs see Figure 5-8 and Figure 5-9.

Outputs

The meter has two types of output. The SØ type is designed to switch up to 24VDC and 24mA. The output is isolated from all other circuits, except for other inputs or outputs on the same terminal block. If the shared circuit is an active input, there is also a connection to the RS232 or RS485 port ground.

One relay output may also be fitted. The relay contacts are rated to 2A, 240VAC with an inductive load. This output should not be used as a pulsing output for transmitting energy pulses, as the output contacts are subject to contact bounce and are not rated for continuous switching. The relay can be turned on indefinitely, and is primarily designed to switch small loads or drive an external contactor.

For the locations of the outputs see Figure 5-8 and Figure 5-9.

Battery

The battery is used to run the clock during loss of power. It also allows the meter LCD to be activated while main power is not available.

The meter comes with an optional internal battery. There is no provision for an external battery at present. The internal battery is a 3.0V, 700mAh Lithium cell. It is connected during manufacture.

A low battery indicator is displayed on the LCD if the battery is not present or is depleted – the level this occurs at can be configured. The battery usage life is longer than 10 years on continuous backup with the 700mAh batteries at 25°C. In normal operation the battery should last for more than 10 years.

The battery is soldered into the PCB, and is thus not considered to be replaceable.

LCD/Select Button

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and 4 seven-segment digits to display description (Figure 4-13). It has arrows to indicate import and export for active and reactive energies, indicators for display sets A and B, battery indicator, currency indicator, connection type indicator for connection through local or remote port and units and multipliers. The LCD does not have a backlight
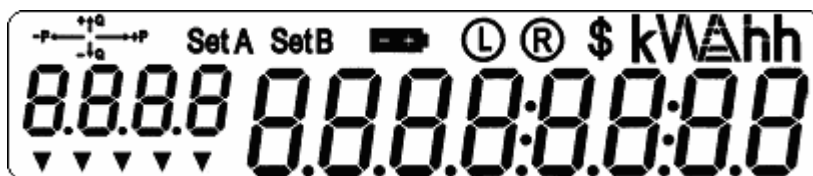
- Figure 5-16 LCD with all segments turned on

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

For more detailed information on the LCD and *Select* button see Chapter 7: "LCD Display".

Connect / Boost Button

An optional *Connect, Boost*, or *Billing Reset* button may be fitted on the left hand side of the meter (SeeFigure 4-14). The push button cannot be sealed.

- Figure 5-17 Location of the *Billing Reset* / *Boost* button

When used as a *Connect* button (also called a *Reconnect* button), holding the button down for at least half a second will connect the customers supply, if it is enabled for connection. The display will show "Connect". If it is not enabled, the display will show "not enabled" and the contactor state will not change.

Pushing both the *Select* button and the *Reconnect* button at the same time will cause the contactor to be disconnected. The message "Disconnect" will be displayed on the LCD.

The *Reconnect* button can also cause a boost operation for load control outputs, depending on configuration.

Note that the relay may not change state immediately. If another operation has just been performed, it may take 60 seconds to perform the requested operation.

EziView can configure what operations are permitted using the button. EziView can also be used to configure the button as a billing reset button - go to Security Setup and un-check the *Billing Reset Button Disabled* checkbox. Since the button cannot be sealed though this is of limited use.

Fitting a Modem

The meter has an optional extended terminal cover which allows a GSM/GPRS modem to be fitted under cover, and within the terminal cover seal of the meter. Figure 5-18 shows a meter with the cover fitted.

- Figure 5-18 Meter with an Extended Terminal Cover fitted

The modem is securely mounted under the cover, and a clear cover keeps it in place and protects the modem and wiring from the main TB1 wiring. The clear cover clips into position, and can be easily removed to access the modem. The modem shown in Figure 5-19 is an ETM9300 GSM/GPRS modem from ETM Pacific.

- Figure 5-19 An ETM9300 modem fitted to the meter

The SAM2 GSM/GPRS modem from InterCEL is also supported, as shown in Figure 5-20. The modem is connected to the meter via a short cable, which plugs directly into the meters RJ45 modem port, and also supplies power to the modem.

- Figure 5-20 A SAM2 modem fitted under the terminal cover

A space is kept between the modem and the front of the terminal cover, to allow for an antenna to be fitted under the terminal cover as shown in Figure 5-21. In good signal areas, this allows for easier installation. If the internal antenna is not good enough, an external antenna may be fitted instead.

- Figure 5-21 Antenna fitted under the terminal cover

Servicing

The meter is not designed for field servicing and has no user serviceable parts. The meter has no internal fuses. In the event of failure of the meter, contact EDMI or your local agent for servicing.

.The Mk10E Meter

This chapter covers the basic installation and physical features of the Mk10E meter.

Dimensions and Mounting

Figure 6-1 shows the overall dimensions of the meter with a standard terminal cover.
The height excludes the buttons and the ANSI fitting if present.

- Figure 6-1 Overall dimensions of the meter

Height = 262 mm, Depth = 95 mm, Width = 175 mm

Height is 290 mm with an extended terminal cover.

Figure 6-2 is a view from the back of the meter.

169.79mm

79.25mm   79.25mm

For mounting use 3 screws with a threaded section
not larger than 5mmØ with a screwhead not smaller
than 8mmØ.
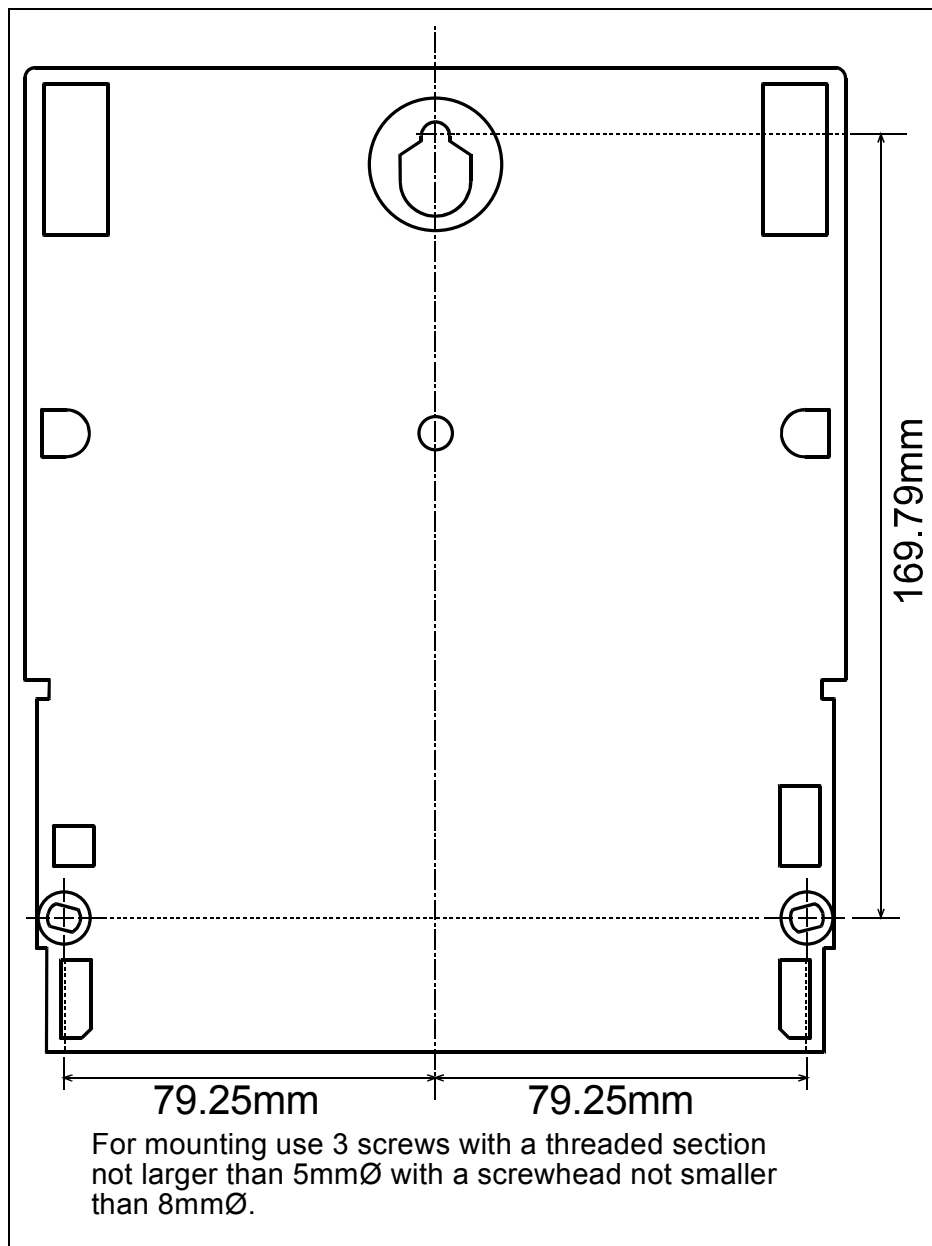
- Figure 6-2 Mounting points

The meter is mounted using three screws. In general:

4. Screw the first (top) screw into the wall. Leave enough space between the head and
    the wall for the plastic around the keyhole.

5. Hang the meter on the screw using the keyhole in the back of the meter.

6. Insert the remaining two screws (meter base, under the terminal cover) to hold the meter securely.

External Features

Figure 6-3 shows a view of the front of the meter (the specifics of your label will vary).

- Figure 6-3 Front view of the meter with terminal cover fitted

The major parts visible in Figure 3-3 include:

- The LCD display.

- A *Select* button for cycling the display (bottom push button).

- A sealable *Billing Reset* or *Reconnect* button (optional) to initiate a manual billing reset (top push button).

- Two pulsing LEDs for energy indication (PO1 and PO2).

- A FLAG or ANSI port for local connection.

Beneath the terminal cover (accessible by removing the two sealable screws on the top of the terminal cover) is the terminal block for voltage and current, connectors for the pulsing inputs and outputs (optional), the optional RS-232 or RS-485 interface, and the optional external battery

The sealable screws have 2.15mm diameter holes to accommodate standard sealing wire.

Under the Terminal Cover

Most of the connections to the meter occur under the terminal cover. Figure 6-4 shows the terminals available on a 4 I/O / RS-232 meter.
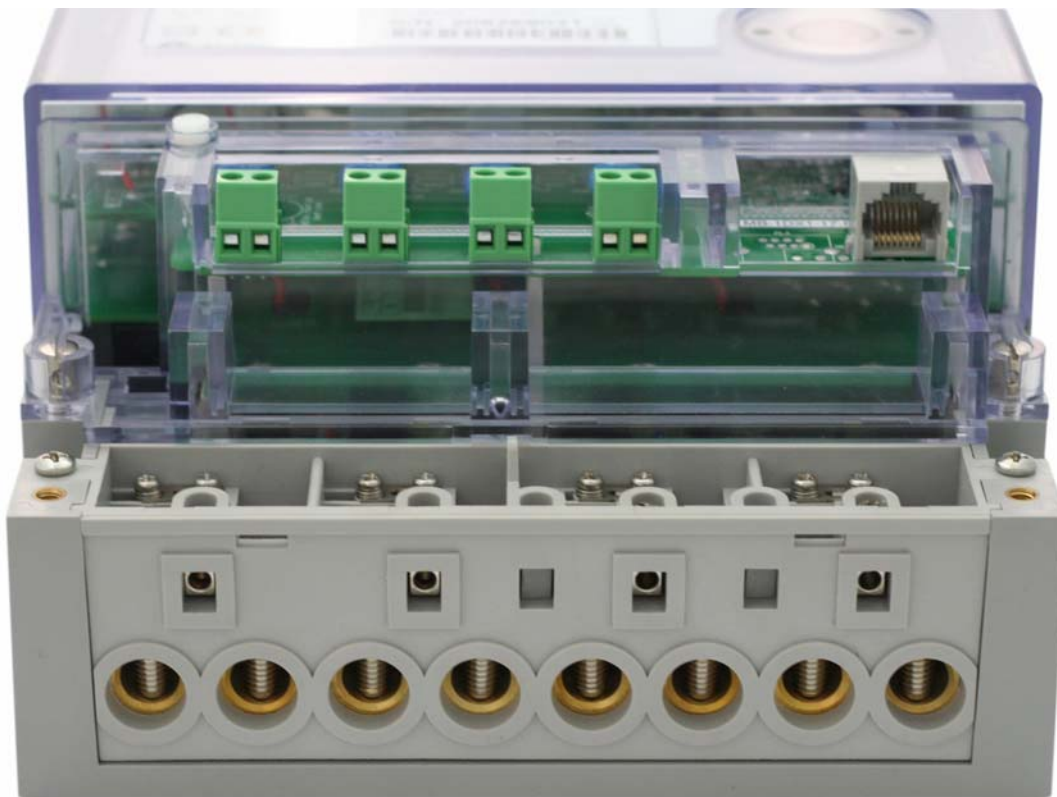
- Figure 6-4 Under the terminal cover of the meter

Diagrammatically, this is shown in Figure 6-5 with the terminal block numbering.
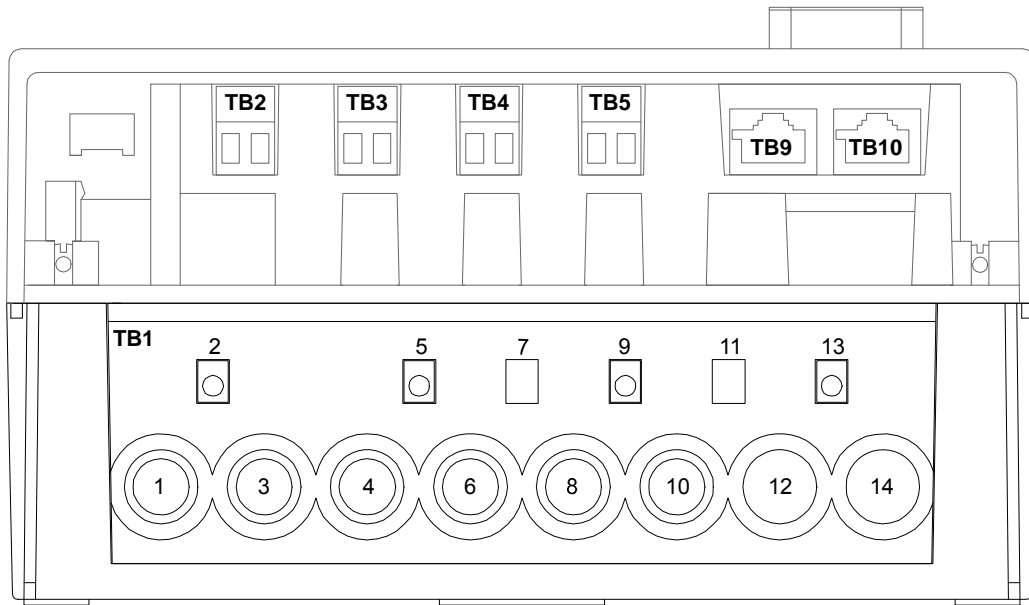
- Figure 6-5 Terminal block diagram

Table 6-1 lists the terminal block connections.

Terminal	Description
TB1	Voltage and current inputs.
TB2	Input PI3 or Output PO3.
TB3	Input PI4 or Output PO4.
TB4	Input PI5 or Output PO5.
TB5	Input PI6 or Output PO6.
TB9	Second RJ45 connector for some communication options.
TB10	RJ45 connector which is hardware configured to either RS485 or RS232, or a 5 way terminal block for RS485.

- Table 6-1 Terminal block connections

Figure 6-6 gives the terminal spacing of TB1.
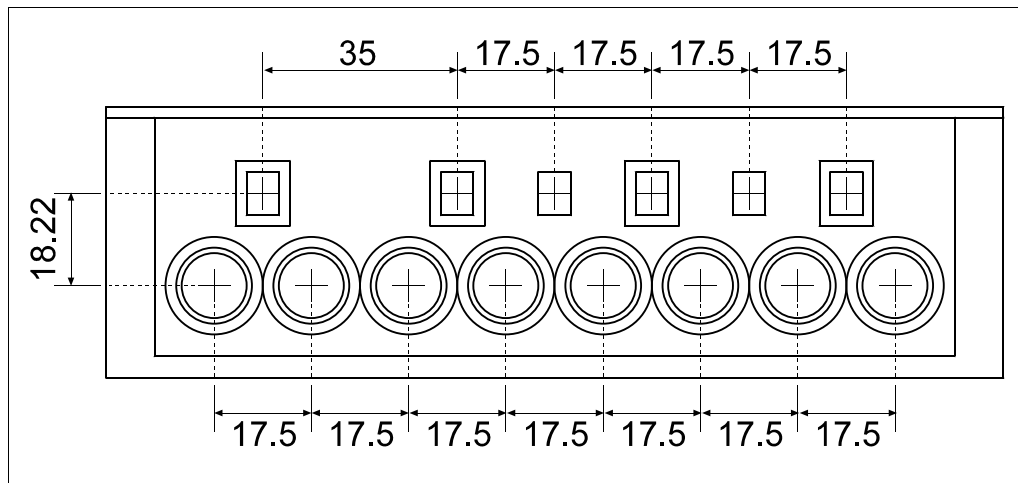
- Figure 6-6 TB1 terminal spacing

Terminal Block Variations

There are two variations of the terminal block – one with internal VT to CT links, and one with external VT to CT links. The external model includes numbering on all terminals and an optional sealable finger guard. The terminal spacing and locations are unchanged.

Terminal Cover Tamper Detect

The meter has an optional switch that can detect the opening of the terminal cover. It is located above and to the left of the terminals (See Figure 6-7). The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the terminal cover.

- Figure 6-7 The terminal cover tamper detect button

Meter Lid Tamper Detect

The meter has an optional switch that can detect the opening of the meter lid. The meter can generate an EFA alarm and an event in the log when the switch is released by someone opening the meter lid.

Under the Meter Lid

Removing the sealable screw allows the meter lid to be removed. Generally connections to the I/O connectors do not need to be detached to allow the cover to be removed. Removal of the meter lid is required to access the *Config Jumper*, and to add or remove the CT to VT links on meters with old style terminal blocks.

⚠️ Care must be taken as dangerous voltages are present in the circuitry under the meter lid while the meter is active. Most of the circuitry is at neutral potential.
Even when the meter is not powered, care should be taken to prevent electrostatic damage to the circuitry of the meter.

CT to VT Links

Whole current meters have CT to VT links between TB1 terminals 1 and 2, 4 and 5, 8 and 9, 12 and 13. There is also a fixed link between 12 and 14. These links may need to be removed to allow testing on some types of test bench. There are two options for removing them. The first option has external VT to CT link connections. Figure 6-8 shows the location of the links, just above the terminal block.

- Figure 6-8 Location of the CT to VT links.

To remove the link connections either loosen the screws, slide the metal shims to the right and retighten (Figure 6-9), or remove the left hand screws completely for better isolation (Figure 6-10).

- Figure 6-9 Meter with the CT to VT links disconnected by sliding shims.

- Figure 6-10 Meter with the CT to VT links disconnected by removing screws.

The second option has no external VT to CT links, so the meter lid must be removed to change the links. Figure 6-11 shows the location of the links in this case, just above the terminal block.
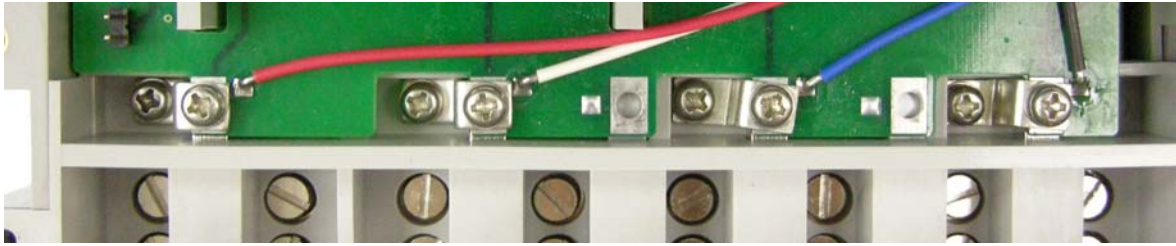
- Figure 6-11 Location of the CT to VT links.

To remove the link connections, remove the four screws and washers from the deeper set of holes. This disconnects the links. Figure 6-12 shows the meter with the screws removed.
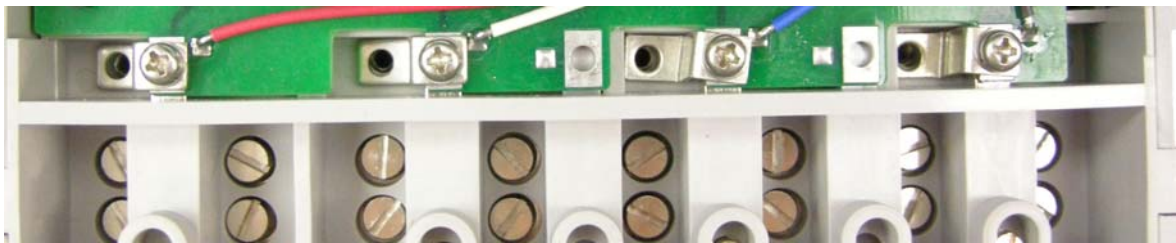
- Figure 6-12 Meter with the CT to VT links disconnected by removing screws.

Config Jumper

The *Config* jumper offers a level of hardware security to the meter – the jumper needs to be fitted to allow calibration and recovery of lost passwords. The jumper is located under the meter lid, along the top of the meter on the right side above the LCD (Figure 6-13). A jumper is fitted across the set of pins marked *Config*. The other set of pins marked *FTest* are for factory use only.
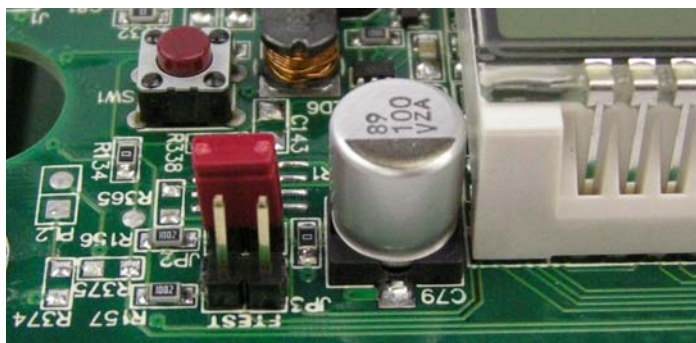
- Figure 6-13 Location of the *Config* jumper

Connections in Detail

Current and Voltage
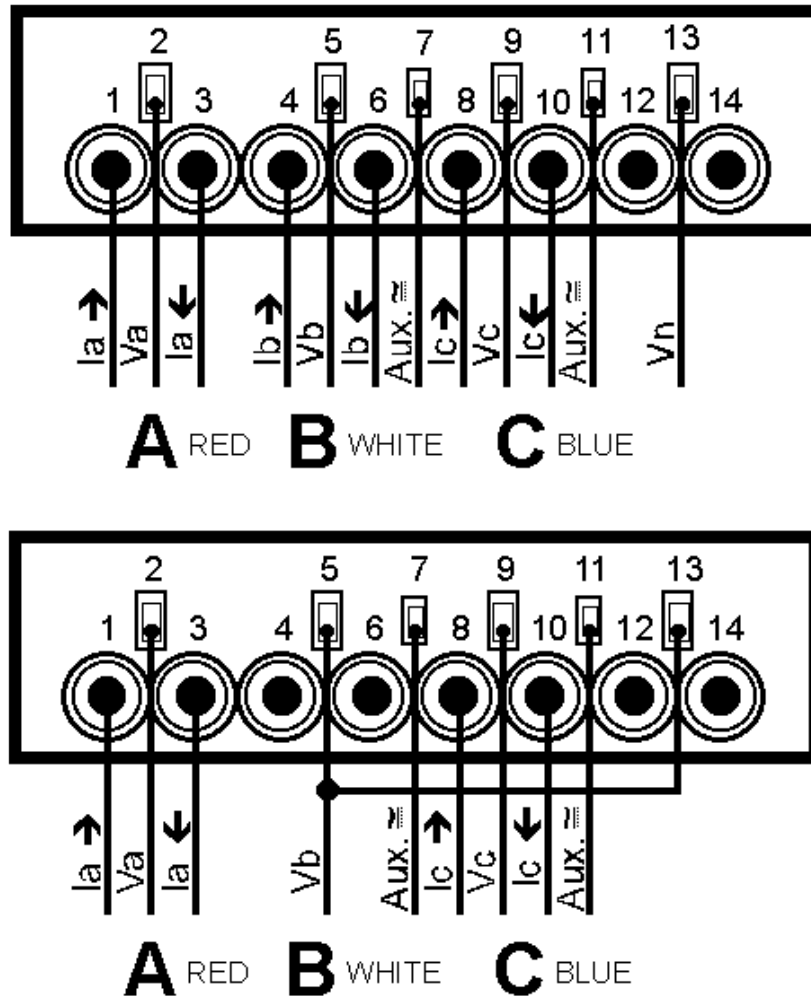
- Figure 6-14 TB1 CT and VT connections for 3 element (top) and 2 element (bottom).

Figure 6-14 shows the two possible connection methods in either 2 (3 wire) or 3 (4 wire) element mode. No internal modification to the meter is required to make it measure in 2 element (3 wire) or 3 element (4 wire) mode. For proper accuracy (especially when measuring VA in 2 element mode) the measurement method must be set to 2 element using EziView (see the *External Transformers* chapter in the Atlas Software Reference Manual.). The connection to terminal 5 is not required in two element mode. Terminals 12 & 14 are not fitted in CT connected meters.

The nominal voltage input range dependant on the model number of the meter. The current range depends on the current range of the meter, and should be limited to Imax.

In 3 element mode (4 wire) the maximum line to neutral voltage is 290V and the maximum line to line voltage is 500V. When in 2 element (3 wire) configuration the maximum line to line voltage is 290V. At any higher voltage the meter will not operate correctly and damage may occur.
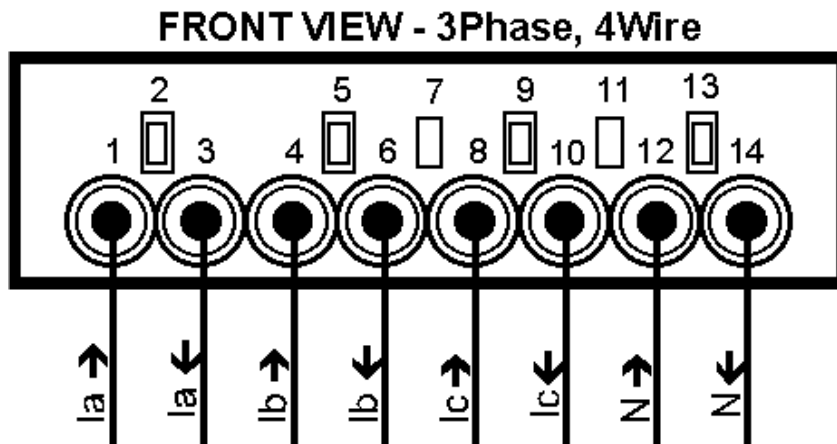
- Figure 6-15 Connections for 3 element whole current

Figure 6-15 shows the normal connections for a whole current meter. The neutral connection must be made, even if it is not connected to both 12 and 14. The VT/CT links connect TB1 terminals 1 to 2, 4 to 5, 8 to 9, and 12 to 13 to 14. The links are fitted under the main meter cover, discussed earlier in this chapter.
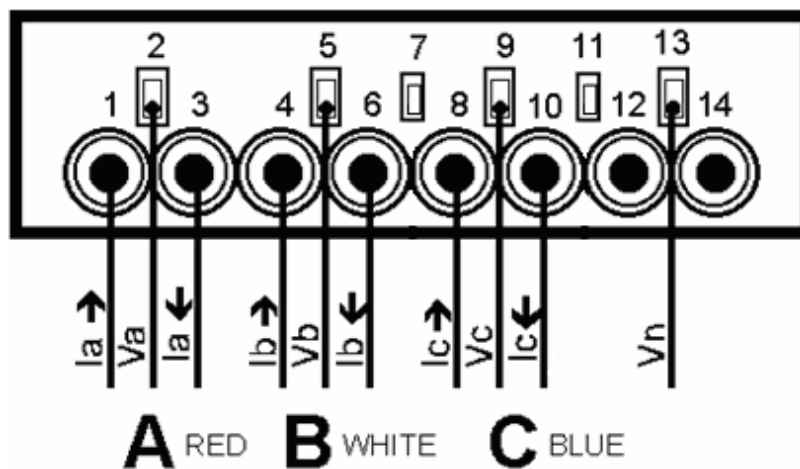
- Figure 6-16 TB1 CT and VT connections for 3 element testing

Figure 6-16 shows the connection methods in 3 element (4 wire) mode when VT/CT links are not fitted.

Serial Port Configurations

The meter has an option of one or two RS-232 ports, which can be arranged in a number of configurations with an RS485 port. The two ports are called Modem and SCADA. The possible options are listed in Table 6-2, which lines up with the order code options.

Type	Modem Communications
0	None
1	RS232 with RJ45
2	RS485 (4-wire) with 2xRJ45
3	RS485 (4-wire) with Screw Terminals
4	RS485 (2-wire) with 2xRJ45
5	RS232 with RJ45 and Modem Power Supply
6	RS232 with RJ45 + SCADA Port on Pin 7 & 8
7	RS232 with RJ45 and Modem power supply + SCADA port on Pin 7 & 8
8	RS232 with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
9	RS232 with RJ45 and Modem power supply + SCADA port 2nd RJ45 Pin 5 & 6
D	RS485 (4-wire) with RJ45 + SCADA Port on Pin 1 & 2
E	RS485 (4-wire) with RJ45 and Modem power supply + SCADA port on Pin 1 and 2
F	RS485 (4-wire) with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
G	RS485 (4-wire) with RJ45 and Modem power supply + SCADA port on 2nd RJ45 Pin 5 & 6
H	RS485 (4-wire) with 2xRJ45 + SCADA Port on 1st RJ45 Pin 1 & 2
I	RS485 (4-wire) with 2xRJ45 and Modem power supply + SCADA port on 1st RJ45 Pin 1 & 2
J	RS485 (2-wire) with RJ45 + SCADA Port on Pin 1 & 2
K	RS485 (2-wire) with RJ45 and Modem power supply + SCADA port on Pin 1 and 2
L	RS485 (2-wire) with RJ45 + SCADA Port on 2nd RJ45 Pin 5 & 6
M	RS485 (2-wire) with RJ45 and Modem power supply + SCADA port on 2nd RJ45 Pin 5 & 6
N	RS485 (2-wire) with 2xRJ45 + SCADA Port on 1st RJ45 Pin 1 & 2
P	RS485 (2-wire) with 2xRJ45 and Modem power supply + SCADA port on 1st RJ45 Pin 1 & 2

- Table 6-2 Serial port options

Where only one RJ45 is fitted it is TB10 that is fitted. TB10 is the 1st RJ45 and TB9 is the 2nd RJ45. The SCADA port is always RS232 in these options.

The connection on the label is indicated using a range of symbols that explain what the connections are. For instance:

corresponds with a Type 7 port. There is only one RJ45 (TB10), it is a dual connector (2 serial ports on the one connector), power is supplied (⏻), and both ports are RS232 (the top port is the Modem port, the bottom is the SCADA port).

RS-232

The RS-232 port on the meter uses an RJ45 connector, which complies with the RS-232D standard. To connect to a modem, use a modem with an RJ45 connector, or use an RJ45 to DB9 connector adapter. RTS/CTS hardware handshaking is not supported.

See Table 6-3 for connection details of TB10. Pin 1 of the RJ45 is on the right hand side.

RS232D RJ45 From Meter	RS232C DB9 To Modem	RS232C DB9 To PC (Null)	Description	Full Name
TB10-1 *	(9)	(9)	+14	+14V,3.6W output
TB10-2				Not Connected
TB10-3	4	1	DTR	Data Terminal Ready (from meter)
TB10-4	5	5	GND	Ground
TB10-5	2	3	RX	Receive Data (to meter)
TB10-6	3	2	TX	Transmit Data (from meter)
TB10-7			RX2	Receive Data–SCADA port
TB10-8			TX2	Transmit Data-SCADA port

- Table 6-3 RS-232 connections

* TB10-1 is connected to a +14V power source from the meter, which is designed to power an external GSM modem. Other options are also available, contact EDMI for more details. Some early meters may have been built with a 2W limit – check with EDMI if you have a concern.

See Figure 6-4 and Figure 6-5 for the location of the RJ45 connector. It is designated as TB10.

RX2 and TX2 are only present if the port is a dual RS232 port.

When the SCADA port is on TB9, the connections are as per Table 6-3 except that TB10-3, TB10-7, and TB10-8 are not connected.

RS-485

The RS-485 port on the meter has the factory option of either an RJ45, or a 5 way terminal block. Table 6-4 lists the connections. Pin 1 of the RJ45 is on the right hand side). Pin 1 of the terminal block is on the left hand side.

RJ45	Terminal Block	Description	Full Name
TB10-1		TX2	Transmit Data-SCADA port
TB10-2		RX2	Receive Data-SCADA port
TB10-3	1	TX+ (A)	Transmit +
TB10-4	5	GND	Ground
TB10-5*		+5	+5V,140mA output
TB10-6	2	TX- (B)	Transmit Data
TB10-7	4	RX- (B)	Receive -
TB10-8	3	RX+ (A)	Receive +

- Table 6-4 RS-485 connections

*TB10-5 is connected to a +14V power source from the meter.

To operate the meter in two wire mode, simply wire TX- to RX- and TX+ to RX+. These may be wired together as a factory fitted option.

Note that the 5-pin terminal block has a different pinout to the EDMI mk6 and mk3 meter RS485 ports.

See Figure 6-4 and Figure 6-5 for the location of the connector. The 5 way terminal block is fitted in the same place (instead of) the RJ45 shown.

RX2 and TX2 are only present if the port is a dual RS485/RS232 port, and in this case RX2 and TX2 are RS232 signals.

One fitment option is two RJ45's wired in parallel (TB9 and TB10) – useful for wiring a series of meters together using premade cables.

FLAG Port

The meter can have either a Flag Port or an ANSI Port. Use a standard FLAG (IEC1107 physical standard) read head to connect the meter to a PC.

Note that it has occasionally been found that some FLAG heads need to be rotated 180 degrees for them to work. If you have problems try this.

ANSI Port

The meter can have either Flag Port of ANSI Port. Standard Flag and ANSI read heads should work with the meter. Please note that older EDMI ANSI read heads will not work with the meter. To use a smart read head that can automatically switch polarity, set the DTR line to be low – see *Configure* in the *Site Properties* section of the *EziView Basics* chapter in the Atlas Software Reference Manual.

Inputs

The inputs may either be active, or passive. Passive inputs are isolated from all other circuits, including the other inputs. There are a variety of input voltages that may be ordered with the meter, e.g. 12V and 240V. Under voltage will cause the input to trigger erratically or not at all, while over voltage will cause excessive heat dissipation and possible damage to the meter.

The rated voltage is the voltage that must be applied between the two terminals of the input. The inputs work with any polarity, and with AC or DC signals. There are a maximum of 4 inputs.

Active inputs are also available as a factory option. They use power from the serial port, and are thus not isolated from the serial port, or from each other. In this case simply shorting between the input terminals will cause the input to trigger. The maximum external impedance is 500 ohms. The inputs will continue to work when power is cycled to the modem.

Outputs

There are several types of outputs available. All outputs are isolated from all other circuits, including other I/O.

The SØ outputs are designed to switch up to 24VDC and 24mA.

The relay outputs are rated to 2A, 240VAC with an inductive load, or 5A, 240VAC for the high current version. These outputs should not be used as pulsing outputs for transmitting energy pulses, as the output contacts are subject to contact bounce and are not rated for continuous switching.

The BOSFET outputs are rated up to 240V, 100mA. They may switch either AC or DC voltages, any polarity.

Battery

The battery is used to run the clock during loss of power. It also allows the meter LCD to be activated while main power is not available.

The external battery is a 3.6V, 700mAh Lithium battery, or a 3.0V, 700mAh Lithium battery. The internal battery is a 3.0V, 700mAh Lithium batteries. Only one battery can be used at one time, the meter will use the one with the highest charge.

If an internal battery is used, a jumper will be connected to JP1 to enable the battery – this jumper is under the meter cover, near the battery.

A low battery indicator is displayed on the LCD if the battery is not present or is depleted – the level this occurs at can be configured. The battery usage life is longer than 10 years on continuous backup with either of the 700mAh batteries at 25°C. In normal operation the battery should last for more than 10 years.

To eliminate the possibility of data loss it is best to change the battery while the meter is running. Care must be taken as the battery is at the potential of the neutral terminal.

The battery is at the potential of the neutral terminal. If conditions (such as wiring configuration) make this a dangerous operation then steps should be taken to ensure that it is safe to do so. While the risk of coming into contact with the conductors during a battery change is minimal, care must be exercised.

Super Cap

The Mk10E meter can be fitted with a Super Capacitor. The Super Cap performs the same job as the battery described above. In the event of a power loss the Super Cap keeps the meter's clock running and preserves the memory contents.

The Super Cap will keep the meter running in the event of a power loss for a minimum of 7 days. This is particularly useful in conserving battery life on a meter fitted at a site where there are frequent, short duration outages. While the Super Caps recharge in a short period once power is restored, they should be charged (by connecting power to the meter) for a minimum of 12 hours to obtain the full alive time.

LCD/Select Button

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and 7 seven-segment digits to display description (Figure 6-17). It has arrows to indicate import and export for active and reactive energies, indicators for phase voltage, indicators for display sets A and B, battery indicator, connection type indicator for connection through local or remote port and units and multipliers.
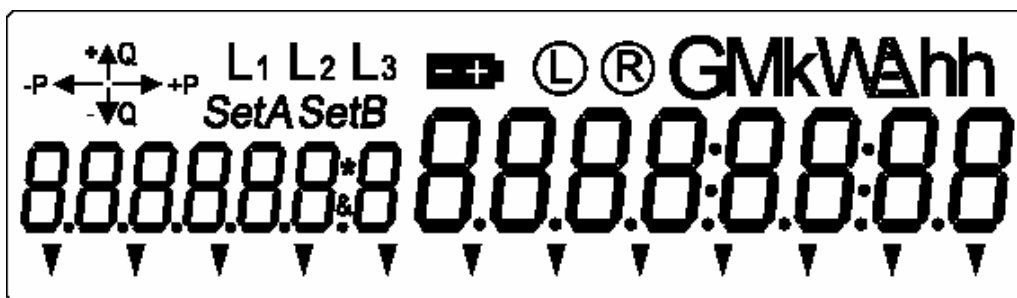
- Figure 6-17 LCD with all segments turned on

The LCD has an optional backlight.

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

For more detailed information on the LCD and *Select* button see Chapter 7: "LCD Display".

Reconnect/Boost/Billing Reset Button

The *Reconnect* button is the top of the two push buttons beside the display. The push button has a 2.5mm diameter hole through it, allowing it to be sealed using standard sealing wire. This button may be used to trigger connection of an external contactor.

Holding the button down for at least half a second will connect the customers supply, if it is enabled for connection. The display will show "Connect". If it is not enabled, the display will show "not enabled" and the contactor state will not change.

Pushing both the *Select* button and the *Reconnect* button at the same time will cause the contactor to be disconnected. The message "Disconnect" will be displayed on the LCD.

The *Reconnect* button can also cause a boost operation for load control outputs, depending on configuration.

Note that the relay may not change state immediately. If another operation has just been performed, it may take 60 seconds to perform the requested operation.

EziView can configure what operations are permitted using the button. EziView can also be used to configure the button as a billing reset button - go to Security Setup and un-check the *Billing Reset Button Disabled* checkbox.

Servicing

The meter is not designed for field servicing and has no user serviceable parts. The meter has no internal fuses. In the event of failure of the meter, contact EDMI or your local agent for servicing.

LCD Display

The LCD is primarily for displaying information from the meter's registers for meter readers. It is also useful during installation, configuration, and diagnosing problems. It has 8 seven-segment digits to display values and up to 7 seven-segment digits to display description. It has arrows to indicate import and export for active and reactive energies, indicators for phase voltage, indicators for display sets A and B, battery indicator, connection type indicator for connection through local or remote port and units and multipliers.

LCD Variations

There are several variations of the LCD display for different meters, mostly varying in the number of enunciators and id digits. They all operate in a very similar manner though, presenting a series of pages of information. Each page can display a single register's contents. On the display the smaller digits at the left are the label for the display, and the larger digits to the right are the value.

The Mk10 and Mk10E display (Figure 7-1) has 7 label digits, and 12 enunciators.
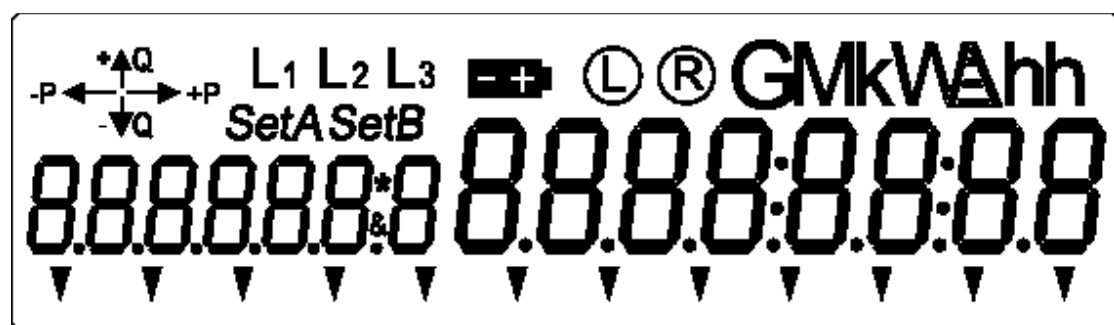
- Figure 7-1 LCD with all segments turned on

There is also a Chinese version of the LCD as shown in Figure 7-2.

- Figure 7-2 Chinese LCD with all segments turned on

The Mk10D LCD is the same as the Mk10, but some of the segments are unused (Figure 7-3). It has only 5 label digits, and 11 enunciators.
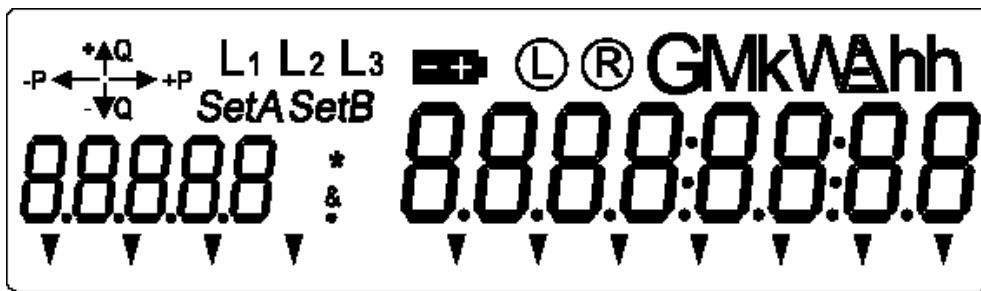
- Figure 7-3 Mk10D LCD with all segments turned on

The Mk10A LCD (Figure 7-4) is similar to the Mk10, but has 6 label digits and 10 enunciators. It adds a currency symbol and a SCADA port symbol, but drops the G and M multipliers, and limits the decimal places to 4.
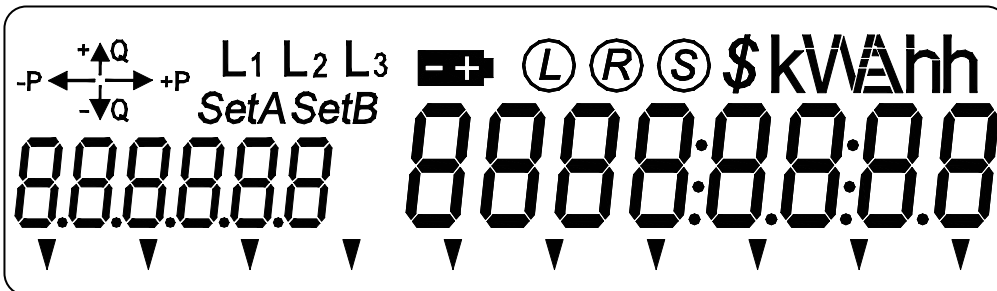
- Figure 7-4 Mk10A LCD with all segments turned on

The Mk7 LCD is very similar to the Mk10, but has fewer features and is physically smaller (Figure 7-5). There are 4 label digits, and 5 enunciators.

- Figure 7-5 Mk7 LCD with all segments turned on

LCD/Select Button Usage

The data is displayed on the LCD as a series of pages, up to a maximum of 90. The number of maximum pages depends on the number of Specials and Annuals days specified in the cal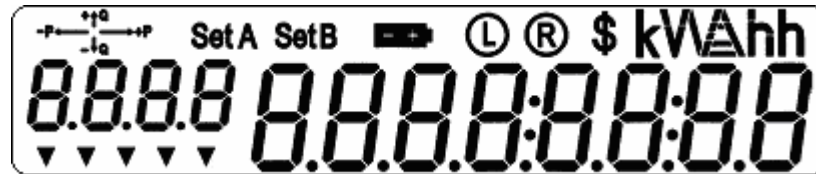endar in the Tariff Setup, daylight saving entries, miscellaneous strings and other data in this space. Each page displays a single quantity from the meter. The left seven-segment characters show the description and the right seven-segment characters show the value, with an optional unit showing above the value.

If the display is too long to fit into the 8 characters of seven-segment, the display will scroll a character every second to show the entire line. An underscore "_" shows the start of the line. The 7 characters of the seven-segment display on the left will not scroll. Thus a description will have to be abbreviated to a maximum of 7 characters.

To progress to the next page, press the *Select* button. Each time the button is pressed the display moves to the next page. The display may also be setup to automatically cycle the display through the pages, pausing if the *Select* button is pressed.

The LCD can come with or without a backlight. The backlight may be set to only activate while the LCD is in use, which is recommended to reduce power consumption. The turn on time of the backlight can be configured using EziView. The backlight does not operate when running on the UPS battery.

If the meter is off (no voltage applied), pressing and holding the *Select* button will wake up the meter using its internal battery (it may take up to a second for the meter to wake up). All LCD screens may be viewed in this mode, including alternate display sets. This allows a manual meter reading even if power is lost. The display will automatically turn itself off after the *No Power Timeout* (configured in EziView, see the LCD chapter in the Atlas Software Reference Manual).

Note that the meter does not measure in the wakeup state, and the communication ports do not operate. The time the meter is woken up is still counted as off time in the emter runtime counters.

Display Sets

In order to make it easier to find a certain page and to allow for different users of the LCD, each page belongs to a display set. Only pages from the current display set are shown. There are two display sets – A and B. Firmware 1.40 introduces 4 display sets – A, B, C, and D. To change display sets press and hold the *Select* button for a second. Set D cannot be entered unless the terminal cover or lid is open, to effectively restrict access to meter installers.

The LCD will indicate the change in display set as seen on the LCD as either SetA for A, SetB for B, flashing SetA for C, flashing SetB for D, The LCD will then change to display the new display set, starting with the first page in the set.

Holding the *Select* button down for 10 seconds takes the display to a special predefined set (Set AB, both SetA and SetB are lit). This includes screens such are serial number and time/date to facilitate diagnostics. Holding the button as per changing display sets will revert to Set A.

EziView can also force the LCD to display a particular page, in which case neither SetA nor SetB are lit.

Default Display

If there is no LCD screen setup in the meter, the time will be shown as a default page.

The example display of Figure 7-6 shows Import active energy, which is a page in Display Set A.
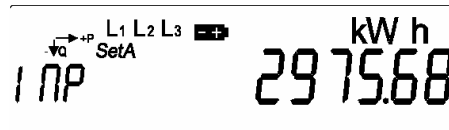
- Figure 7-6 Example of first page of Set A LCD display

If there is an LCD setup, the first display page in display set A will be shown when the meter is powered up.

Display Organisation

In general, the organisation of the display from the top left is as follows (Table 7-1):
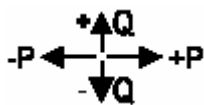
The four arrows with characters and plus/minus sign at the top left display the direction of Watts and vars respectively. A plus sign indicates positive/export/delivered energy, while a minus sign indicates negative/import/received

energy[1].

L₁ L₂ L₃

The three characters show presence of phase voltage. L1 represents phase A voltage, L2 represents phase B voltage and L3 represents phase C voltage. Not present on Mk7.

Low Battery indicator. Please refer to the section on the battery earlier this chapter.

L shows local communication or login on the local port. R shows remote communication or login on the modem port. The R will flash if the meter is connected to the GPRS network in persistent mode but no one is logged in.

S shows local communication or login on the SCADA port, Mk10A only.

Currency indicator, Mk7 and Mk10A only.

GMk

GMk is the multiplier. G for Giga, M for Mega and k for kilo. M and G are not available on Mk7.

VAhh

These segments allow for display of units. The units are W, var, VA, Wh, varh, VAh, V and A.

SetA SetB

Display set as explained in the Section LCD/Select Button above.

Label in seven-segment characters. There can be a maximum of 7 characters to describe the value shown in the value digits on the right side of the LCD. The Mk10 has 7, the Mk7 has 4, the Mk10D and Chinese displays have 5, and the Mk10A display has 6. The size of each seven-segment character is 7.75 mm x 3.45 mm for a Mk10 size display, 6.15 mm x 3.23 mm for a Mk7 size display.

8 characters of seven-segment displays register contents as setup in LCD setup. The size of each seven-segment character is 10.7 mm x 4.67 mm for a Mk10 size display, 9.30 mm x 4.35 mm for a Mk7 size display.

The enunciators allow various meter states to be displayed, and may be paired with a customised label.

- Table 7-1 Sections of the LCD

---

[1] Please refer Figure A-1 for Measurement Convention.

The energy direction arrows, battery, communication status, and phase presence indicators are not related to the register being shown, they are a display of the meter's state.

As the LCD is a numeric type, alphabetic characters are difficult to display. The meter will attempt to display them as best it can, but readability will vary depending on the letter.

.System Specifications

This appendix covers the basic specifications of the meter.

Measured Quantities and Methods

The meter can measure the quantities listed in Table A-1.

Quantity	Units	Description
Watt hours	Wh	The total Wh.
var hours	Varh	The fundamental varh. In 2 element mode calculated from sqrt(VAh ^{2} - Wh ^{2})
VA hours	VAh	The total VAh, calculated from Vrms x Irms. In 2 element mode calculated from sqrt(Wh ^{2} + varh ^{2})
Watts	W	The total W.
vars	Var	The fundamental vars. In 2 element mode calculated from sqrt(VA ^{2} - W ^{2})
VA	VA	The total VA, calculated from Vrms x Irms. In 2 element mode calculated from sqrt(W ^{2} + var ^{2})
Voltage	V	True RMS voltage.
Current	A	True RMS current.
Frequency	Hz	Fundamental system frequency.
Phase Angle	Degrees	Angle between Fundamental Voltage and Fundamental Current.
Phase to Phase Angle	Degrees	Angle between Fundamental Voltages.
Power Factor	Ratio	Watts divided by VA. Lead or lag determines the sign.

- Table A-1 Measurements

Note: The sign of VAh is based on the sign of the Wh, as VA itself has no sign..

Operating Conditions

Table A-2 below lists some of the operating conditions of the meters, covering the Mk10, Mk10D, Mk10E, Mk7A, and Mk7C unless otherwise noted. Extended limits for the Mk7A beyond IEC and AS standards have not been tested.

| Quantity	Conditions
Standards	The meter complies with the following standards
IEC	IEC 62052-11 (2003), IEC 62053-21 (2003), IEC 62053-23 (2003), IEC 62052-21 (2004), IEC 62054-21 (2004)
	Mk10E: IEC 62053-22 (2003), IEC 61038(1990), IEC 61036(1996)
Australian/New Zealand	AS 62052-11 (2005), AS 62053-21 (2005), AS62053-23 (2006), AS 62052-21 (2006), AS 62054-21 (2006), AS 1284.11 (1995) (Mk7), AS 1284.12 (1995) (Mk10/D/A), AS 1284.5 (2000), AS 62052-21 (2006), AS 62054-21 (2006), AS 1284.7 (1994), NMI M6 Pattern Approval (pending for Mk10A), EGRD4
	Mk10E : AS 62053-22 (2005), AS 1284.12 (1995)
European	EN 50470-1, EN 50470-3 (Pending for Mk10E, Mk10A)
Voltage	
Nominal (Un)	220VAC to 240VAC. Mk10E is 57.7VAC to 240VAC
Operating Range	0.8 Un to 1.2 Un (Extended IEC is 1.15 Un)
	0.8 Un to 1.15 Un for Mk7C PLC
Limit Range	0 Un to 1.2 Un (IEC is 1.15 Un)
	0 Un to 1.15 Un for Mk7C PLC
Start up	Time for meter to be fully functional after Un applied is <3s
Overcurrent	Whole Current: 7000A for 3 cycles, 30 Imax for 0.5 cycles
	CT: 20 Imax for 0.5 seconds
Frequency	Mk10, Mk10D, Mk10E, Mk7C, Mk7A Active: 45Hz to 65Hz
	Mk7A / Mk7C Basic, Passive or PLC: 50Hz +/- 5% at Un
	+/- 2% variation for accuracy (per IEC), +/- 6% for Mk10A.
Temperature	
Operating	-25°C to +60°C (3K6 mod)
Limit Range	-40°C to +70°C (3K7)
	Operation at extremes should be limited to <6h
Limit Range for Storage and Transport	-40°C to +80°C (3K7 mod)
	Storage and transport at extremes should be limited to <6h
Dry Heat test	+80°C (IEC is 70°C)
Damp Heat Cyclic Test	+60°C (IEC is 40°C)
Location	Indoor, Australian Outdoor. Mk7C Outdoor.
Relative Humidity	Non-condensing: Annual mean <75%, 30 days 95% (in a natural spread), occasionally 85%

- Table A-2 Operating Conditions

Quantity	Conditions
EMC Environment	Electromagnetic Environment E2, per the 2004/22/EC directive (Pending for Mk10E, Mk10A)
Insulation	Protective class II
Surge Test	5kV (IEC is 4kV)
Impulse Test	12kV (IEC is 6kV) Mk10, Mk10E 10kV (IEC is 6kV) Mk10D, Mk10A, Mk7A, Mk7C 12kV, Ri = 40Ω and 9J (SP1618: voltage input only) Mk10
Mechanical	Mechanical Environment M1, per the 2004/22/EC directive (Vibrations and shocks of low significance) (Pending for Mk10E, Mk10A)
Spring Hammer test	0.5 J (IEC is 0.2 J)
Shock Test	400 m/s2 (IEC is 300)
Vibration test	0.15mm f<60Hz, 2.2g f>60 (IEC 0.075mm f<60Hz, 1g 1>60Hz)
Torque Test	3 Nm current terminal screws, 0.6 Nm voltage terminal screws
Water and Dust	IP53 without suction (as per Australian Outdoor). The Mk7C and Mk10D meet IP54
Solar radiation	IEC 62052-11 (Tested on Mk10, Mk10D, Mk7C, Mk10E, Mk10A)
Rain test	UL50 (3R) (Tested on Mk10, Mk10D, Mk10E, Mk10A)
Salt Spray	IEC 60068-2-11 (Tested on Mk10, Mk10D, Mk7C, Mk10E, Mk10A)
Weather Simulation	DIN 53 387 (ANSI C12.16) (Tested on Mk10, Mk10D)
Thermal Shock	IEC 60068-2-14 (Tested on Mk10, Mk10D, Mk10E, Mk10A)

- Table A-3 Operating Conditions

Energy Conventions

The convention for energy directions is as shown in Figure A-1 below.
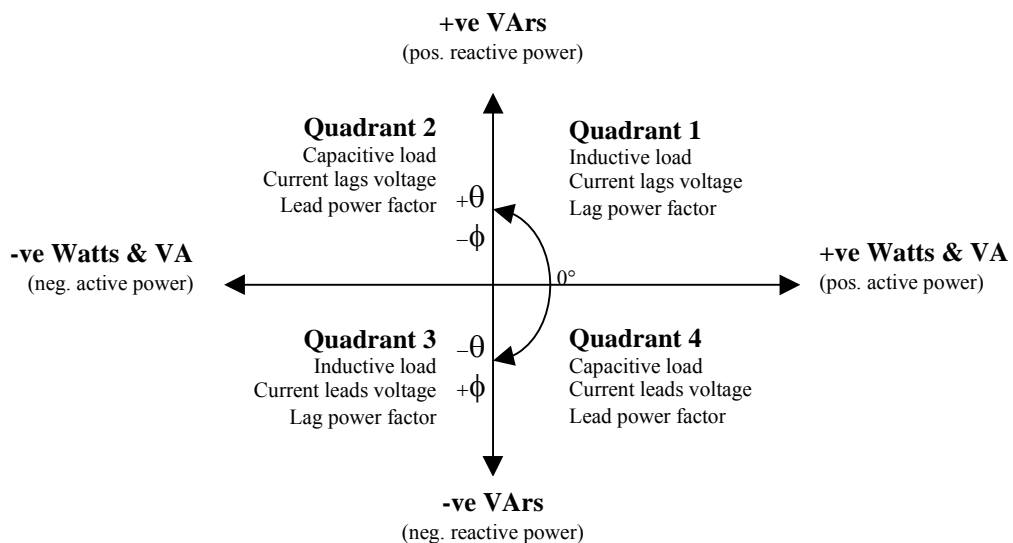
- Figure A-1 Energy Directions

Export is exporting or delivering energy to the customer's load, import is importing or receiving energy from the customer. All conventions are from the point of view of the supply authority.

θ is the impedance angle of voltage with respect to current. ϕ is the admittance angle of current with respect to voltage. The meter measures the angle in terms of current with respect to voltage (ϕ, admittance).

Since conventions change around the world, there is a setting called *Naming Convention* in the EziView *Tools → Options → General* page (Figure A-2). The colour used for each phase may also be edited here.
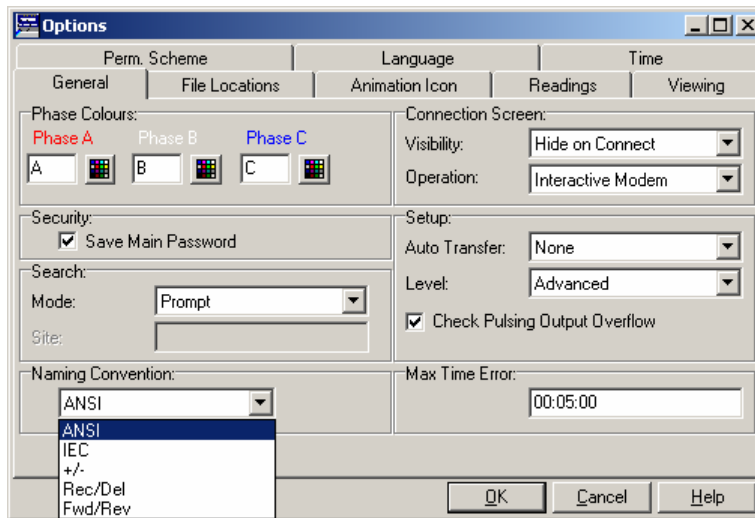
- Figure A-2 *Naming Convention* settings

The naming conventions are as in Table A-4.

Standard	Positive Energy	Negative Energy	Abbreviated
ANSI	Export	Import	Exp/Imp
IEC	Import	Export	Imp/Exp
+/-	+	-	+/-
Rec/Del	Delivered	Received	Del/Rec
Fwd/Rev	Forward	Reverse	Fwd/Rev

- Table A-4 Naming conventions