

# PRIME 500 SERIES

## INSTALLATION, OPERATING AND TROUBLESHOOTING INSTRUCTIONS

### IMPORTANT SAFETY INFORMATION

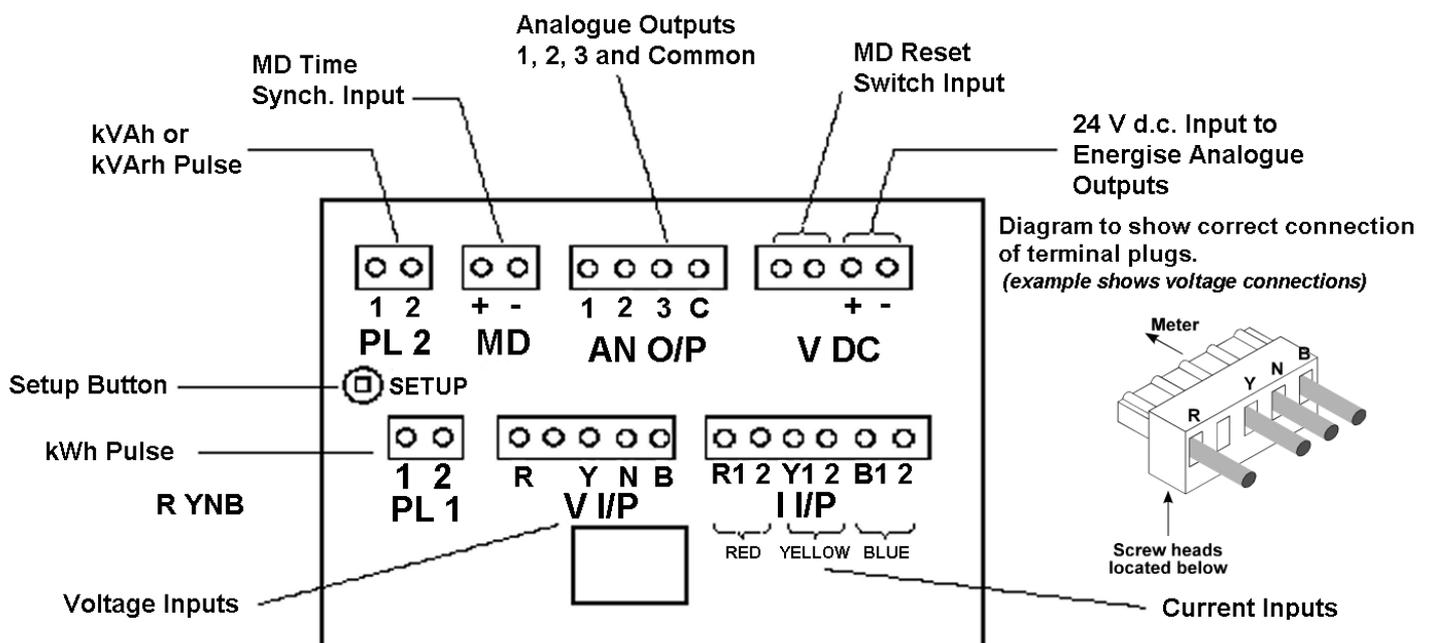
It is important to ensure that the secondary windings of the current transformers are shorted when not connected to the meter. This should be done prior to disconnection from the meter. A current transformer with no load on its secondary can generate very high voltage when a current flows in the primary. For all Prime 500 series meters, access to hazardous voltages is possible on the rear panel, therefore the meter must be mounted such that the rear panel is enclosed and secured against access by anyone other than qualified personnel. Installation of the Prime 500 series requires connection of the unit to hazardous voltages and should only be undertaken by suitably qualified personnel. Various points on the Printed Circuit Board operate at hazardous voltages, therefore unauthorised access to the inside of the unit should be prevented. Prime 500 meters contain a Lithium battery. Care should be taken when disposing of the meter.

### A. INSTALLATION.

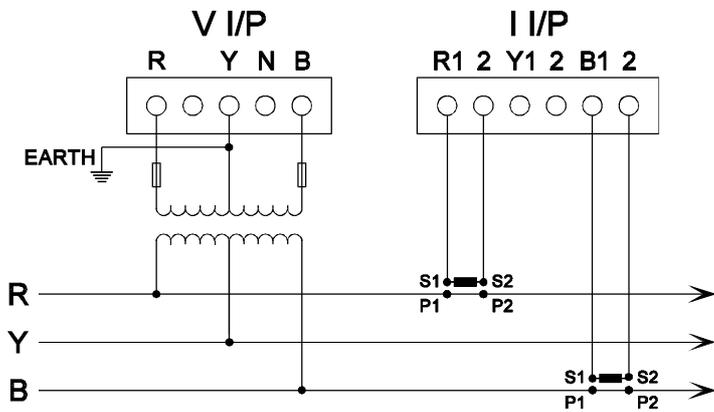
1. The meter requires a panel cutout of 138mm ± 0.5mm x 92mm ± 0.8mm.
2. Place the meter through the panel cutout and place the fixing brackets into the slots on each side of the meter casing.
3. Tighten the thumb screws through the bracket to bear on the rear of the panel, this secures the meter in place. (Note: Tighten the thumb screws only finger tight as excess force could damage the meter.)
4. Make the appropriate connections to the pluggable terminal blocks as per the wiring diagrams shown in Figures 1 to 4.

**Notes:** (i) With a 4 wire installation (Fig 2) failure to make the neutral connection will damage the meter.  
 (ii) With a 3 wire installation (Fig 1 & 4) if only 1 phase is present a unity power factor load is shown correctly as a PF of 0.866.  
 (iii) It is normal practice to common and earth CT secondary leads. Secondary CT connections at meter (R2, Y2 & B2) must also be commoned.

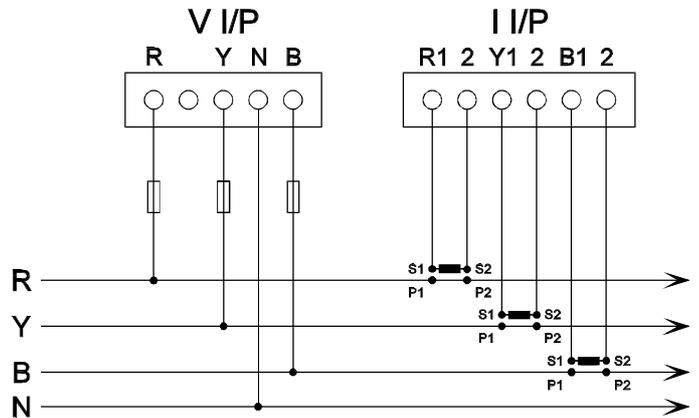
### B. REAR VIEW OF PRIME 500 METER SHOWING CONNECTIONS.



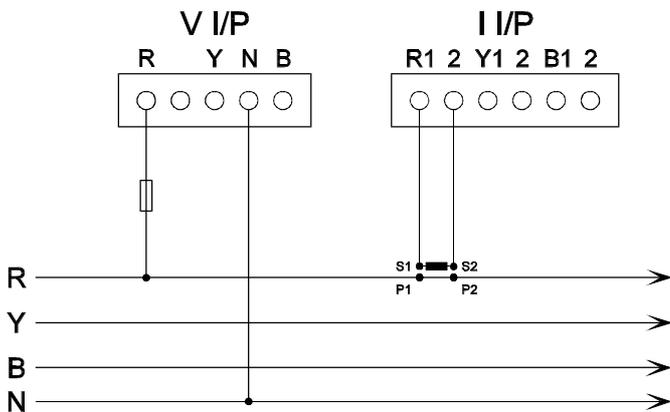
**FIGURE 1. 110V  $\emptyset$  to  $\emptyset$ , 2 C.T. connection to 3 wire supply.**



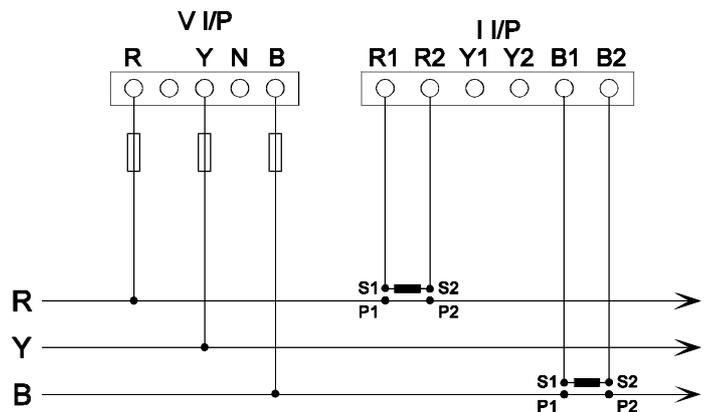
**FIGURE 2. 240V  $\emptyset$  to N, 3 C.T. connection to 4 wire supply.**



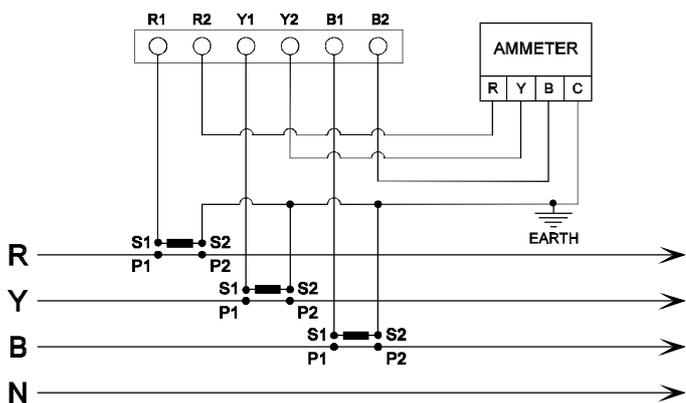
**FIGURE 3. 240V  $\emptyset$  to N, 1 C.T. connection to 2 wire supply.**



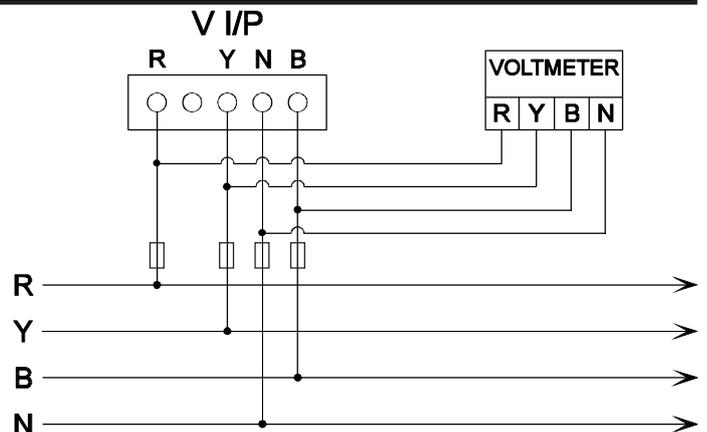
**FIGURE 4. 415V  $\emptyset$  to  $\emptyset$ , 2 C.T. connection to 3 wire supply.**



**FIGURE 5. PRIME connected in series with ammeter**



**FIGURE 6. PRIME connected in parallel with voltmeter**



### C. METER SETUP AND DISPLAYS.

When power is applied to the meter it will display its settings. The content and order of display will depend on the model type chosen. A general list covering the whole Prime 500 range is shown below. To determine the features that a particular model has the part number listed on the label attached to the top case of the meter should be compared to the model selection chart, section D.

#### Setup program

The configuration of the meter may be altered, or completely changed, by following the sequence below:

1. Remove power from the meter, and where applicable, disconnect the optical read head from the front panel of the meter.
2. Depress the rear panel setup button and re-apply power to the meter with the button still depressed.
3. The message "SETUP" will be displayed at which time the setup button should be released.
4. The first parameter to be displayed, the C.T. primary ratio, is set in two stages. The *units* and *tens* columns are set first. The correct figure is reached by pressing the setup button. Once selected the digits will continue to flash for a few seconds, the

*hundreds* and *thousands* can now be set in the same way. If the primary C.T. ratio is a multiple of 100 the *unit* and *tens* columns can be left at "00" and only the *hundreds* and *thousands* columns need to be changed. When the ratio is set the display will again flash for a few seconds before moving onto the next parameter. (*Note:* All Prime 500 meters have a default CT primary ratio of 100A when leaving the factory).

5. The next parameter display will begin to flash and by pressing the setup button the parameter will be altered.
  6. On obtaining the correct value for the desired parameter, release the setup button and after a few seconds the display will cycle onto the next parameter.
  7. Follow steps 5 and 6 for each parameter to be set.
  8. The display rating and pulse rating settings are affected by the Primary C.T. rating programmed in the meter. As the C.T. rating is increased the meter automatically sets the display and pulse ratings to a minimum acceptable resolution. It is then possible to decrease the resolution from this level but not increase.
  9. When the meter displays the message "END" answer "Y" or "N" by depressing the setup button to alternate.
  10. If "Y" is selected it will remain flashing for a few seconds, the display will then blank momentarily while the meter is programmed with new settings after which it is ready for operation and will return to the normal display. If "N" is selected it will remain flashing for a few seconds, the meter will then return to the C.T. Ratio setup display.
- Important: It is vital that the setup procedure is allowed to finish in this way. If the power (voltage) is removed before the meter has been reprogrammed with the new settings, the meter will not register correctly.

Meter Display	Description	Models
SETUP	<b>SETUP MESSAGE</b>	All
1600 A	<b>C.T. RATIO</b> ( Selectable from 5 to 10,000 Amps )	All
3300 P	<b>V.T. RATIO</b> ( Selectable from 2.2, 3.3, 6.6, 11, 13.2, 22, 33, 66, 110, 132, 220, 330 kV )	<b>110V A.C. 3 Wire only</b>
d5r ▽ X1    ▽ X10    ▽ X100    ▽ X1000	<b>DISPLAY RATING</b> ( Selectable from 0.1, 1, 10, 100, 1000 ) (No arrows illuminated indicates a multiplication factor of x 0.1) (x10 and x1000 illuminated together indicates x10,000)	All
Pd 1.00	<b>PULSE DURATION</b> ( Selectable from 0.16, 1.00, 6.00 secs )	<b>All pulsing + Models only</b>
Pr ▽ X1    ▽ X10    ▽ X100    ▽ X1000	<b>PULSE RATING</b> ( Selectable from 0.1, 1, 10, 100, 1000 If pulse duration is set at 6 seconds, the maximum pulse rating must not exceed 9 pulses / minute )	<b>All pulsing + Models only</b>
Pt VA	<b>2nd PULSE TRIGGER</b> ( Selectable from either VA or var )	503+, 504+, 508+, 513+, 514+, 518+, 523+, 528+.
ddt VA	<b>DEMAND TRIGGER</b> ( Selectable from either W or VA)	504, 505, 506, 514, 515, 516, 504+, 505+, 506+, 514+, 515+, 516+
dds 1	<b>DEMAND SYNC</b> ( Selectable from either Internal or External)	504, 505, 506, 514, 515, 516, 504+, 505+, 506+, 514+, 515+, 516+
ddo 00	<b>DEMAND OFFSET</b> ( Internal Sync Selectable from 1 - 29 min )	504, 505, 506, 514, 515, 516, 504+, 505+, 506+, 514+, 515+, 516+
b1 00.00	<b>BEGINNING TIME</b> ( Registers 1 to 4, i.e. b1, b2, b3 & b4 )	<b>505, 515, 505+, 515+</b>
E1 00.00	<b>END TIME</b> ( Registers 1 to 4, i.e. E1, E2, E3 & E4 )	<b>505, 515, 505+, 515+</b>
rt VA	<b>REGISTER TRIGGER</b> ( Selectable from either W, VA, var )	<b>505, 515, 505+ 515+</b>
t 1 0.32	<b>TIME OF DAY</b>	504, 505, 506, 514, 515, 516, 504+, 505+, 506+, 514+, 515+, 516+

## D. MODEL SELECTION CHART

Function/ Display	kWh Display	kVAh Display	kvarh Display	kW Display	kVA Display	kvar Display	Volts Display	Amps Display	4 Rates Display	Max Demand Display	Power Factor Display	Frequency Display	Time Display	Hours Run Display	Hours on Load	kWh Pulse	kVAh Pulse	kvarh Pulse	Demand Sync Input 24V DC	Demand Sync Input 110V AC
Model Type																				
501	<input type="checkbox"/>																			
501+	<input type="checkbox"/>															<input type="checkbox"/>				
502	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>												
502+	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>								<input type="checkbox"/>				
503+	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>													<input type="checkbox"/>	●	●		
504	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>						▽	▽
504+	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>	●	●	▽	▽
505	<input type="checkbox"/>								<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>						▽	▽
505+	<input type="checkbox"/>								<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			▽	▽
506	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>						▽	▽
506+	<input type="checkbox"/>						<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>			▽	▽
507+	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
508+	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>	●	●									

## OPTIONS

### OPTO - PORT

51\* Series models have the same features as the 50\* Series with the addition of a RS232 Optical Communication port.

### ANALOGUE OUTPUT (4-20mA)

521+ As per 501+ with the addition of 1 Analogue output  
523+ As per 503+ with the addition of 3 Analogue outputs  
528+ As per 508+ with the addition of 3 Analogue outputs

Key:  = Function available.  
● = User selectable.  
▽ = Factory set

## E. METER OPERATION

### Selector switch

Prime 500 series meters with multiple displays have a rotary switch on the front panel to select each display. Rotating this switch to the appropriate legend will select the parameter to be displayed.

### Display rating

The energy and power display(s) have an annunciation arrow(s) below the display which is highlighted to indicate the multiplication factor which should be applied to the main display value. It is important to note that the absence of any annunciator arrow indicates a multiplication factor of 0.1 which should be applied to the display value, and that simultaneous annunciators for x10 and x1000 indicate a x10,000 multiplication. For all other instantaneous displays the annunciator arrow does not apply. As the Primary C.T. rating is increased the meter will automatically set the display rating to a minimum acceptable level. It is possible to decrease the resolution of the display from the rating set by the meter but not increase. (Acceptable levels are as per Table 1.)

### Current & Voltage displays

For meters with current and voltage displays there are three applicable settings on the front mounted selector switch used to view the parameters. When either Voltage "V" or Current "I" is chosen the display will scroll through each phase in turn and then repeat. A low voltage 4 wire model will display phase to phase and phase to neutral voltage and the line current for each phase. A high voltage 3 wire model will display voltage for Red phase to Yellow phase, Blue phase to Yellow phase and Red phase to Blue phase. It also displays the line current for each phase. In between the two selector positions for voltage and current, the lock ("LCK") position is used to hold the display on any particular voltage or current phase reading. The display will not be frozen, but will be continually updated.

### Maximum Demand display

For maximum demand displays a bar is illuminated on the far right of the display to indicate the demand trigger selected. (kW or kVA).

### Maximum demand reset

The maximum demand can be reset by turning the meter front panel switch to the "MD" position and depressing the rear panel button. Alternatively a remote key switch is supplied with every Prime meter that has maximum demand facility. The switch barrel can be flush mounted in the panel next to the meter. The maximum demand can be reset by turning the remote key switch clockwise. The display will count down to reset. Releasing the button / switch before the display reaches zero will abort reset (see section H for further information).

## F. METER DIAGNOSTICS

Once installed a diagnostic test can be performed by pressing the rear panel button with power applied to the meter. This can only be conducted when the current flowing through the primary current transformer circuit is greater than 5% of the current transformer primary ratio programmed in the meter setup.

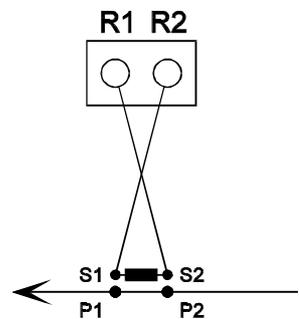
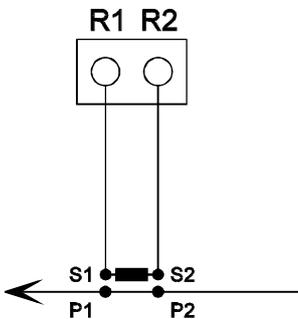
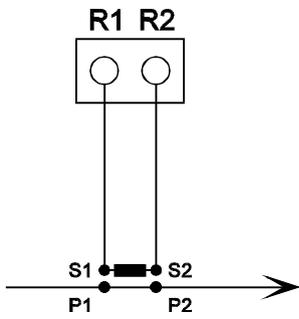
The meter will perform a C.T. polarity check, displaying the messages "R", "Y" or "B" (phases) with the appropriate direction of current flow, "I" for import, "E" for export. All phases should read Import for correct meter operation. All connected phases must be the same polarity. There is no model within the current Prime 500 range which can monitor both the Import and Export of electricity simultaneously. If the meter is required to monitor the energy generated then connections should be made so that each phase is still shown as Importing electricity. The energy displays and outputs, if fitted, will then only register the energy generated (Refer to Figure 9, connection diagram for monitoring the generated energy). If the displayed polarity is incorrect the meter will not register correctly. To reverse the polarity of a current transformer the secondary leads (S1 S2) must be swapped at the meter terminals. (Note: The Current Transformers should not be open circuit when under load as the high voltage generated can be dangerous to equipment and personnel) The polarity test will be followed by a display test, seven segments should be illuminated.

Meter Diagnostic Display	Description	Models
06r   1 CORRECT	<b>C.T. TEST RED PHASE</b> ( Import / Export )	All
06y   E INCORRECT	<b>C.T. TEST YELLOW PHASE</b> ( Import / Export )	All
06b   1 CORRECT	<b>C.T. TEST BLUE PHASE</b> ( Import / Export )	All
88888888	<b>DISPLAY TEST</b>	All

**FIG 7. C.T. polarity test = Import (I)**

**FIG 8. C.T. polarity test = Export (E)**

**FIG 9. C.T. connections to monitor Exported energy**



**G. PULSED OUTPUTS.**

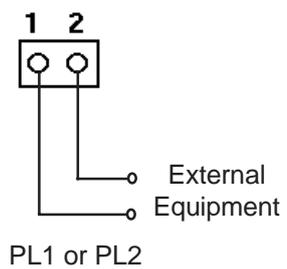
All "500+" versions of the Prime series meter are fitted with one or two pulsed outputs. The kWh pulse is produced in the form of a volt free contact at connections PL1 on the rear panel of the meter.

The kWh and kvarh pulse is also a volt free contact, and can be found on PL2 on the rear panel. The trigger (source) of the kWh and kvarh pulse is user selectable and is described in section C. The connection details of PL1 and PL2 are same and are shown opposite.

If the pulse duration is set to 6 seconds, the meter may be unable to produce the correct number of pulses in the given time. Please contact PRI for information on whether the pulse rate will be sufficient for the rated power of your system.

**Note:** The pulse rating is set independently of the display rating. The annunciator arrows below the display only apply to the display rating and not the pulse rating.

The following table describes the default pulse energy rating which the meter will choose, based on the voltage and current transformer values. You may change the pulse energy rating to a higher value using the meter's built-in setup program, in which case the table will no longer apply.



Rated Voltage	Range of rated current	kWh per pulse (default)	Rated Voltage	Range of rated current	kWh per pulse (default)
240V or 415V	5-10A	N/A	2.2kV	5-15A	0.1
	15-100A	0.1		20-185A	1
	105-1000A	1		190-1885A	10
	1005-10000A	10		1890-10000A	100
3.3kV	5-10A	0.1	6.6kV	5-60A	1
	15-125A	1		65-625A	10
	130-1255A	10		620-6295A	100
	1260-10000A	100		6300-10000A	1000
11kV	5-35A	1	13.2kV	5-30A	1
	40-375A	10		35-310A	10
	380-3775A	100		315-3145A	100
	3780-10000A	1000		3150-10000A	1000
22kV	5-15A	1	33kV	5-10A	1
	20-185A	10		15-125A	10
	190-1885A	100		130-1255A	100
	1890-10000A	1000		1260-10000A	1000
66kV	5-60A	10	110kV	5-35A	10
	65-625A	100		40-375A	100
	620-6295A	1000		380-3775A	1000
	6300-10000A	10000		3780-10000A	10000
132kV	5-30A	10	220kV	5-15A	10
	35-310A	100		20-185A	100
	315-3145A	1000		190-1885A	1000
	3150-10000A	10000		1890-10000A	10000
330kV	5-10A	10			
	15-125A	100			
	130-1255A	1000			
	1260-10000A	10000			

## H. MAXIMUM DEMAND.

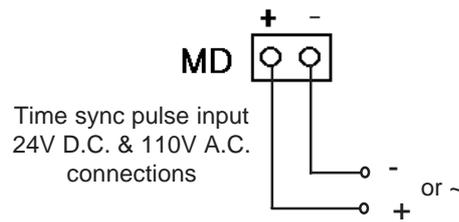
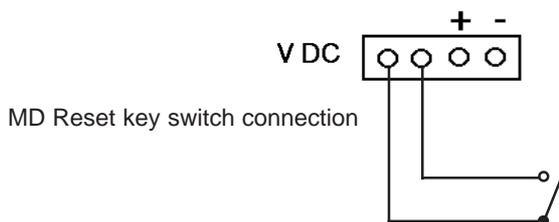
The Prime 504, 505 and 506 meters have a Maximum Demand display. The 30 minute demand period may be selected as described in section C, as being synchronised from either an external source or internally from the Prime meter clock at the hour / half hour. If internal synchronisation is selected, a demand offset can be specified ( 1 - 29 min ) by which synchronisation will be delayed past the hour / half hour. This enables demand period synchronisation with an existing demand meter.

For external synchronisation a voltage is specified on the configuration label on the meter casing, of either 24V D.C. or 110V A.C. An external pulse at the specified voltage should be applied to the plug marked M.D. on the rear panel of the meter and last between 200ms and 1000ms. The connection details are shown below. The M.D. may be reset via the rear panel button or the external keyswitch supplied with the meter as described in section D. Connection details and cutout sizes for the keyswitch are shown opposite.

19mm Dia

3.2mm semi circle dia

External MD reset key switch panel cutout

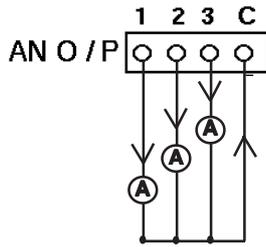


## I. ANALOGUE OUTPUTS..

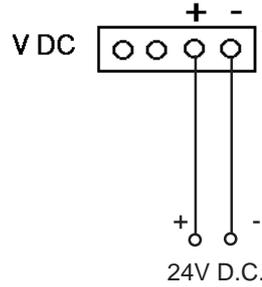
All versions of the Prime 520 series are fitted with analogue outputs. The number of outputs ranges from 1 to 3, and are dependant upon the model type chosen. The analogue outputs provide a 4-20mA current output. The parameters represented by each output are factory set and are listed on the label attached to the top of the meter case.

The output current circuitry is electrically isolated from the meter and therefore an external 24V D.C. supply is required to provide power.

The 24V D.C. supply (regulated, +/- 5%) should have a capacity of 20mA per analogue output, plus 40mA. (e.g. If 3 outputs are used, capacity= 3 x 20 + 40mA = 100mA). The connection details of the analogue outputs are shown below:



The ammeters illustrated may be replaced by resistors or a building management system.



## J. POWER.

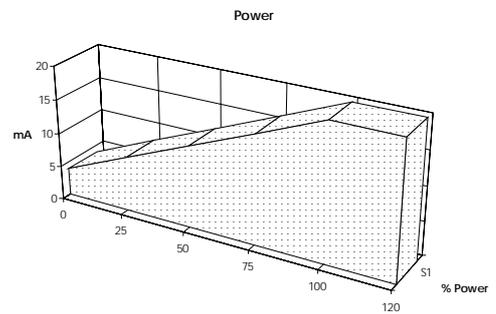
The full scale of the analogue output\* kW Import, kvar Import and kVA Import / Export, will be at 100% power as defined by the following calculations:

For 240V 4 wire meters;  $3 \times 240 \text{ Volts} \times \text{Current primary} = 100\% \text{ power.}$

For 110V 3 wire meters;  $\sqrt{3} \times \text{Voltage primary} \times \text{Current primary} = 100\% \text{ power.}$  [NB: For meters manufactured before July 1994, use the formula  $2 \times \text{Voltage} \times \text{Current primary} = 100\% \text{ power.}$ ]

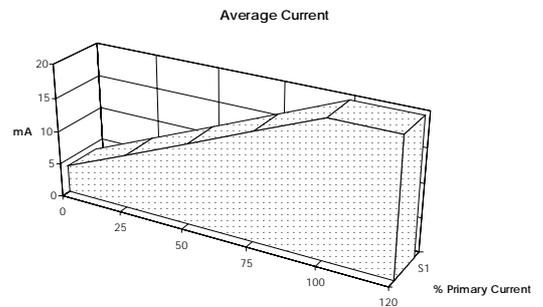
( V.T. and C.T. settings of meter are displayed on power up.)

\* kW or kvar export power will produce fixed outputs of 4mA.



## K. AVERAGE CURRENT.

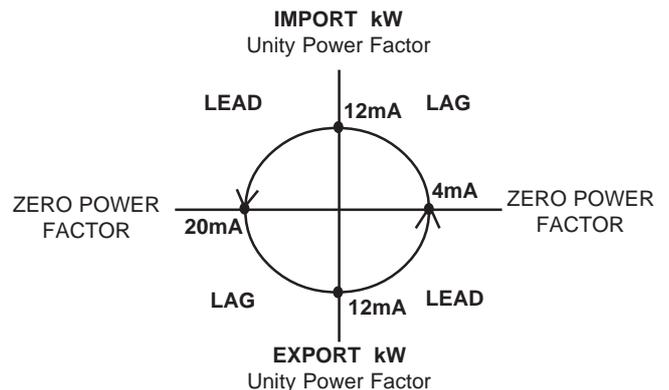
The I rms analogue output will represent the average of the current on the 3 phases for a 4 wire meter or the 2 phases for a 3 wire meter. Full scale will be achieved when the average is equal to 100% of the meter primary current.



## L. POWER FACTOR.

For Power Factor, the analogue output will operate as shown\* opposite:

\*Below 0.5% of full scale kVA, the analogue output of Power Factor will be fixed at unity (12mA) to avoid fluctuation under no load.



## M. TROUBLESHOOTING GUIDE

This guide contains the steps to be followed if a Prime 500 meter does not appear to be working correctly.

All stages of the meter setup procedure (section C.) must be carefully completed. If the meter is wrongly configured it will not operate correctly. It is vital that the setup procedure is allowed to finish in the correct way. Incorrect readings are often caused by wrong configuration. If the Prime meter does not appear to be working the following steps should be taken.

### MODEL TYPE

- 1 There are a number of models within the Prime 500 range of meters with various features. If the meter does not function as intended the model type should be confirmed to ensure that the unit actually has the features required. The paper label on the top case of the meter includes an eight digit part number which can be used to determine the model type and relative features. (See section D for product selection chart)
- 2 The meter hardware must be compatible with the voltage supply that it is monitoring. The meter label states the voltage system that the meter is designed to be connected to. The three options are:

240 Volt, Phase to Neutral , 3 phase, 4 wire, 50Hz (Low voltage)

110 Volt, Phase to Phase, 3 phase, 3 wire, 50Hz (High voltage)

415 Volt, Phase to Phase, 3 phase, 3 wire, 50Hz (Low voltage)

*(Note: A Prime 500 meter may be used to monitor a 240Volt, 2 wire, single phase supply, the meter label however will indicate a 240 Volt, 3 phase, 4 wire, supply).*

If the supply that the meter is to monitor does not correspond with any of the above then the meter should not be connected, please contact your supplier.

### VISUAL INSPECTION

If the unit is confirmed to be the correct model type and suitable for the voltage supply then inspections should be made to ensure that:-

- 3 All terminal connections at the rear panel of the meter are correct and secure. (see section B for diagram of terminal connections).
- 4 Voltage references are connected to the correct voltage inputs at the meter .(e.g. Yellow phase is connected to yellow phase voltage input). See figures 1 to 4.
- 5 Current transformer(s) are connected to the correct current inputs at the meter ( e.g. The current transformer installed around the Red phase is connected to Red phase current inputs - R<sub>1</sub> R<sub>2</sub>) See figures 1 to 4.

*(Note: If the meter is monitoring a single phase supply then both voltage and current connections are made to the same phase input terminals)*

### DIAGNOSTIC TEST

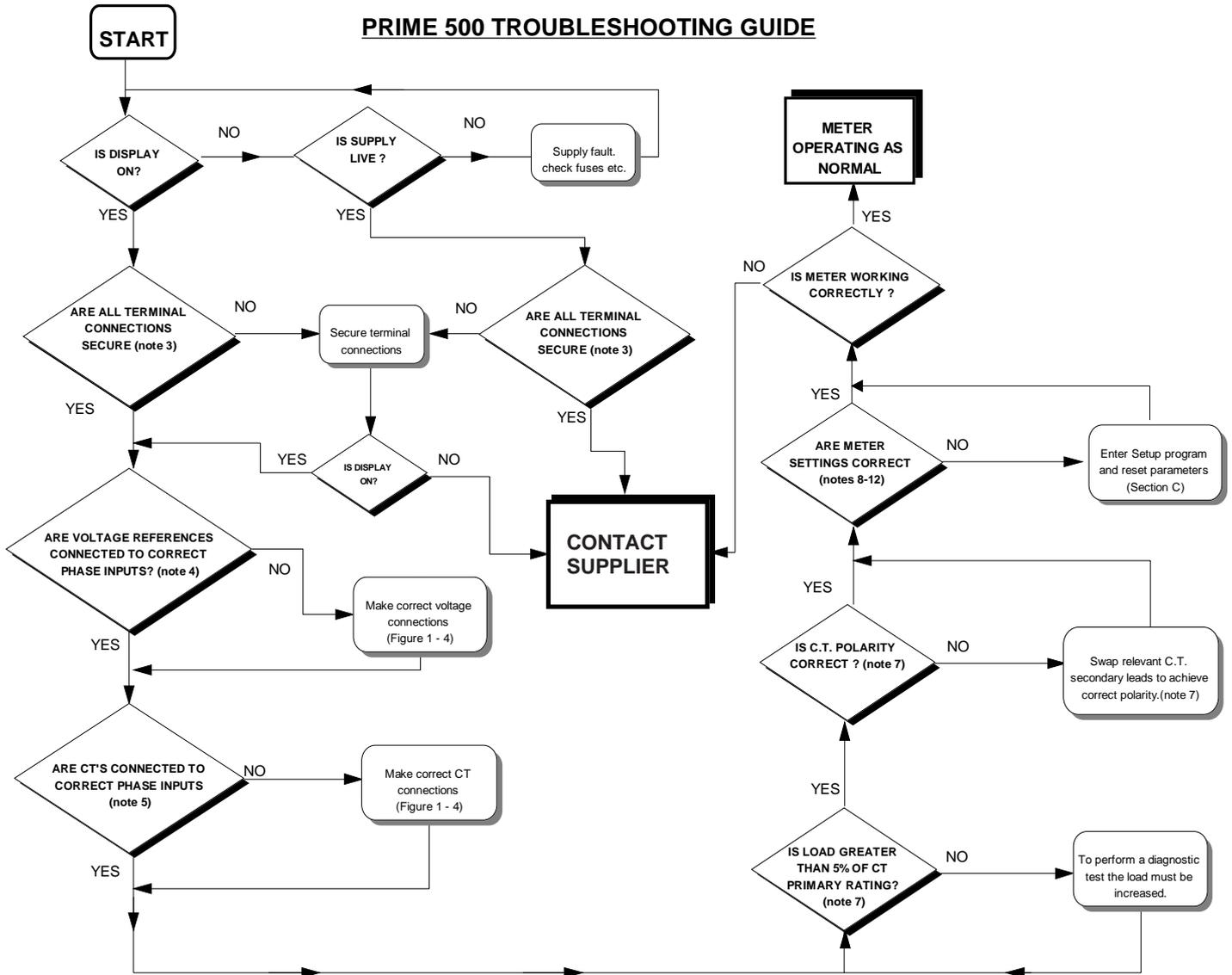
- 6 Is the display illuminated ? - Provided that there is voltage present in the supply being monitored the display should always be illuminated, even if no current is flowing through the current transformers.
- 7 By performing the diagnostic test as described in section F the polarity of the current transformers can be checked. For all models this test should show that each phase is Importing energy. If the polarity is incorrect the current transformer(s) connections must be reversed at the meter inputs. If a meter is connected incorrectly it will either under register the amount of energy consumed or fail to register at all. Figures 7 & 8 show how the different connections will affect the meter readings.

### METER SETTINGS

- 8 If after successfully completing the diagnostic test, the meter does not appear to be operating correctly the meter settings should be confirmed. All of the parameters set can be checked by removing and then reapplying the voltage to the meter, the display will then scroll through each of the parameters in turn, before returning to the normal display.
- 9 All settings should be confirmed as correct in order for the meter to operate as intended, however the Current and Voltage Transformer ratios will have the most impact if wrongly configured.
- 10 **CT Ratio:** The current transformer ratio programmed in the meter must match that of the current transformers connected to the meter . The meter will display the primary ratio setting when the steps outlined in stage 7 are followed. The secondary output required by the meter from the current transformer(s) can be determined from the label on the top case of the meter, this is pre-set to either 1A or 5A.
- 11 **VT Ratio:** For high voltage installations the voltage transformer ratio programmed in the meter must match that of the voltage transformers connected to the meter. The meter will display the primary voltage setting when the steps outlined in stage 7 are followed.
- 12 **Pulsed output settings:** For meters with pulsed output(s) care must be taken when setting the pulse rating and pulse duration values. If the pulse duration is set too high the meter may be unable to produce the correct number of pulses in the given time. If the pulsed outputs produced by a meter appear incorrect the pulse settings should be compared against Table 1 which shows acceptable settings for pulse duration and rating.
- 13 If any of the parameters are wrongly configured, return to section C and reprogram the meter with the correct settings.

## N. TROUBLESHOOTING FLOWCHART

Whatever symptoms occur, if a Prime 500 meter does not appear to be working correctly, the stages outlined in the flowchart below should be followed. It should be used in conjunction with Section M - Troubleshooting Guide and the other sections of the Operating/ Installation Instructions. There are several cross references throughout the flowchart stating "note" numbers which refer to the relevant notes within Section M, as well as references to other section numbers.



If a PRIME 500 does not function correctly after completing all of the tests and checks included in this guide please contact your supplier for further assistance.

Name of Supplier:  
Address:

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