MultiCube – S

Installation and Operation

PREFACE

MultiCube - S
Operating Guide Revision 1.06
February 2002

This manual represents your meter as manufactured at the time of publication. It assumes standard software. Special versions of software may be fitted, in which case you will be provided with additional details.

Every effort has been made to ensure that the information in this manual is complete and accurate. We revised this manual but cannot be held responsible for errors or omissions.

The apparatus has been designed and tested in accordance with EN 61010-1, 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. This operating guide contains information and warnings which must be followed by the user to ensure safe operation and to maintain the apparatus in a safe condition.

We reserve the right to make changes and improvements to the product without obligation to incorporate these changes and improvements into units previously shipped.

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1. Safety

1.1 Warning Symbols

This manual provides details of safe installation and operation of the meter. Safety may be impaired if the instructions are not followed. Labels on individual meters give details of equipment ratings for safe operation. Take time to examine all labels on the meter and to read this manual before commencing installation.

CAUTION
Refer to all Instructions

WARNING
Risk of Electric Shock

Figure 1.1 Safety Symbols

WARNING
The meter contains no user serviceable parts. Installation and commissioning should be carried out by qualified personnel

1.2 Maintenance

The equipment should be maintained in good working order. Damage to the product should be repaired by the manufacturer. The meter may be cleaned by wiping lightly with a soft cloth. No solvents or cleaning agents should be used. All inputs and supplies must be isolated before cleaning any part of the equipment.

2. Meter Operation

2.1 Power Up

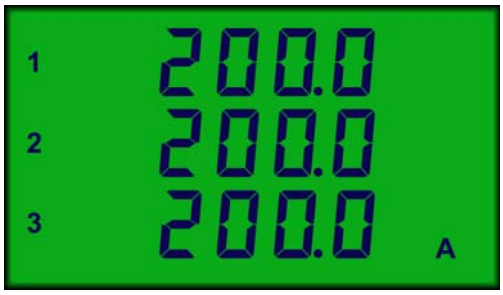
On power up the MultiCube shows the meter type and software issue on the bottom line of the display. A display of "***106-S***" denotes a software version 1.06. During this power up period the meter carries out internal function tests.

2.2 Display Pages

MultiCube Type S Menus			
I/V	**P**	**E**	**>>**
Phase Currents	System PF, Hz, W	Wh Register	Phase 1 PF, V, I
Phase Voltages	Phase Watts	Vah Register	Phase 2 PF, V, I
Line-Line Voltages	Phase VA	Total varh Register	Phase 3 PF, V, I
	Phase var	Inductive varh Register	
		Capacitive varh Register	

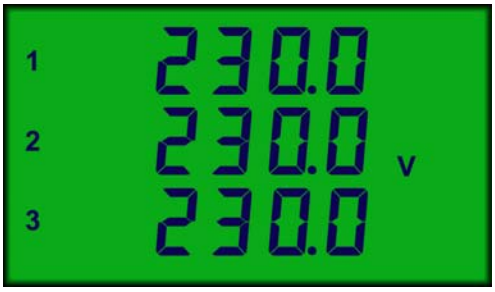
Use the **I/V, P, E or** >> key to select one of the display menus shown in the table above. Press the key repeatedly to select the desired display page. In the >> menu the meter automatically scrolls through each display page in turn.

2.2.1 I/V Menu



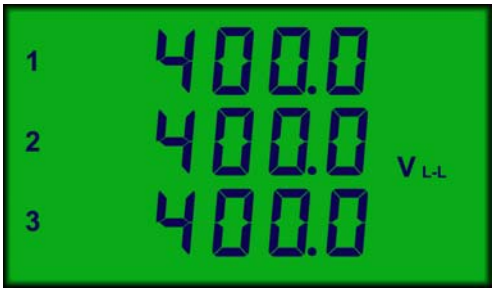
Phase Currents

Instantaneous true rms current on phases 1, 2 and 3, scaled by user programmable CT primary.



Phase Voltages

Instantaneous true rms voltages on phases 1, 2 and 3 with respect to neutral. These readings are scaled by user programmable PT primary.

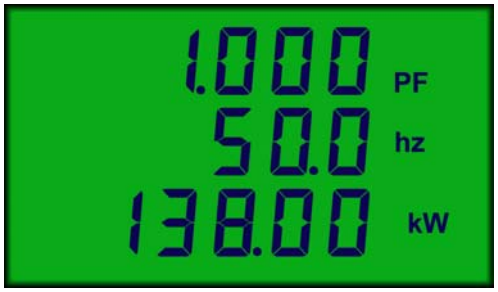


Line-Line Voltages

Instantaneous true rms line to line voltages scaled by user programmable PT primary.

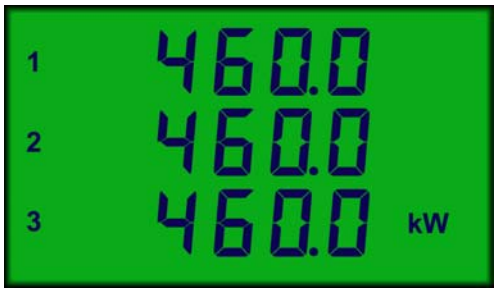
1=Line1-Line2
2=Line2-Line3
3=Line3-Line1

2.2.2 P Menu



System PF, Hz, W

3-Phase Power Factor
'-' Sign denotes a capacitive load.
Frequency measured on phase 1 volts.
3-Phase Watts (W_1+W_2+W_3)



Phase Watts

Per phase true rms watts
scaled by CT and PT settings.

Phase VA

Per phase VA calculated as :
$VA_1 = V_1 \times I_1$
$VA_2 = V_2 \times I_2$
$VA_3 = V_3 \times I_3$
Where V_x and I_x are rms values.

Phase var

Per phase var calculated as :
$var_1 = \sqrt{(VA_1^2 - W_1^2)}$
$var_2 = \sqrt{(VA_2^2 - W_2^2)}$
$var_3 = \sqrt{(VA_3^2 - W_3^2)}$
'-' Signs denote a capacitive load.

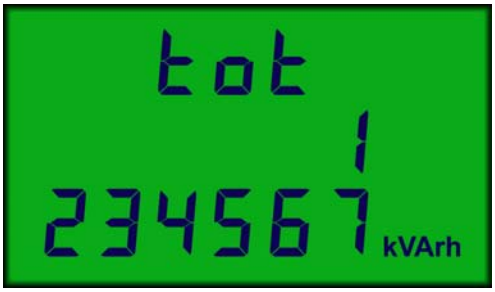
2.2.3 E Menu

Wh Register

System watts integrated over time to give accumulating, import, watt-hours.
Scaling depends on CT and PT settings.
The most significant digit is displayed on the middle line.

VAh Register

System VA integrated over time to give accumulating, import, VA-hours.
Scaling depends on CT and PT settings.
The most significant digit is displayed on the middle line.



Total varh Register

System var integrated over time to give accumulating, import, varh-hours.
Scaling depends on CT and PT settings.
The most significant digit is displayed on the middle line.

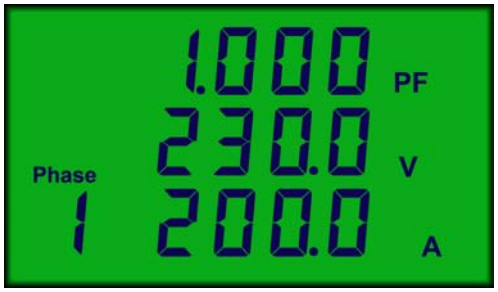
Inductive varh Register

System varh register which accumulates only while the load is inductive.
The most significant digit is displayed on the middle line.

Capacitive varh Register

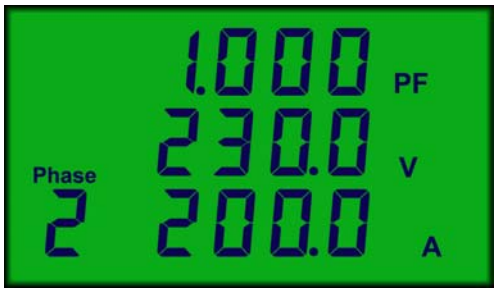
System varh register which accumulates only while the load is capacitive.
The most significant digit is displayed on the middle line.

2.2.4 >> Menu



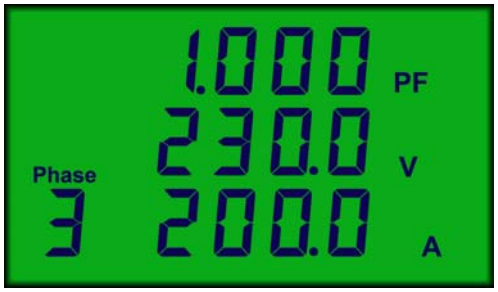
Phase 1 PF, Volts & Amps

Phase 1 PF ('-' denotes capacitive)
Phase 1 Voltage scaled as above
Phase 1 Current scaled as above



Phase 2 PF, Volts & Amps

Phase 2 PF ('-' denotes capacitive)
Phase 2 Voltage scaled as above
Phase 2 Current scaled as above



Phase 3 PF, Volts & Amps

Phase 3 PF ('-' denotes capacitive)
Phase 3 Voltage scaled as above
Phase 3 Current scaled as above

2.3 Display Scaling

The MultiCube scales it's displays automatically to provide the optimum resolution dependant on user settings (CT and PT Primary). This provides direct reading of parameters with decimal points and legends automatically selected (e.g. kW or MW etc).

2.3.1 Phase Voltage Scaling

PT Setting	Example Display
$60V_{L-L}$ - $140V_{L-L}$	20.00 V
$141V_{L-L}$ - $1,400V_{L-L}$	200.0 V
$1,401V_{L-L}$ - $14,000V_{L-L}$	2.000 kV
$14,001V_{L-L}$ - $50,000V_{L-L}$	20.00 kV

2.3.2 Line-Line Voltage Scaling (V_{L-L})

PT Setting	Example Display
$60V_{L-L}$ - $80V_{L-L}$	50.00 V_{L-L}
$81V_{L-L}$ – $800V_{L-L}$	500.0 V_{L-L}
$801V_{L-L}$ - $8,000V_{L-L}$	5.000 kV_{L-L}
$8,001V_{L-L}$ - $50,000V_{L-L}$	50.00 kV_{L-L}

2.3.3 Current Scaling

CT Setting	Example Display
5A - 8A	5.000 A
9A - 80A	50.00 A
81A - 800A	500.0 A
801A - 20,000A	5.000 kA

2.3.4 Per Phase & System Power Scaling (W, VA, var)

PT Setting x CT Setting	Example Display
300VA - 1,400VA	200.0 W
1,401VA - 14,000VA	2.000 kW
14,001VA - 140,000VA	20.00 kW
140,001VA - 1,400,000VA	200.0 kW
1,400,001VA - 14,000,000VA	2000 kW
14,000,001VA - 140,000,000VA	20.00 MW
140,000,001VA – 1,000,000,000VA	200.0 MW

2.3.5 Energy Registers (Wh, VAh, varh)

PT Setting x CT Setting	Example Display
300VA - 1,400VA	999.999 kWh
1,401VA - 14,000VA	9999.99 kWh
14,001VA - 140,000VA	99999.9 kWh
140,001VA - 1,400,000VA	999999 kWh
1,400,001VA - 14,000,000VA	9999.99 MWh
14,000,001VA - 140,000,000VA	99999.9 MWh
140,000,001VA – 1,000,000,000VA	999999 MWh

2.3.6 Miscellaneous (Frequency, PF)

All Settings	Example Display
	1.000 PF
	50.0 Hz

2.4 Energy Register Reset

All accumulating energy registers may be simultaneously reset to zero using the front panel keys. Once reset, energy readings are lost forever so great care must be taken when using this feature.

To reset all energy registers

- Select any energy display page as described above
- Press E and >> keys together and Hold for 5 seconds.

3. Installation

3.1 Panel Mounting

Panels should be of thickness 1mm to 4mm with a square cut-out of 92mm (+0.8 - 0.0). A minimum depth of 72mm should be allowed behind the panel for the meter. Remove the panel mounting clips and insert the meter into the cut-out from the front of the panel. Push the meter home. Ensure the screws in each panel mount clip are fully retracted and insert the clips as shown in the diagram below. Tighten the screws to secure the meter firmly in the panel.

DO NOT OVERTIGHTEN.

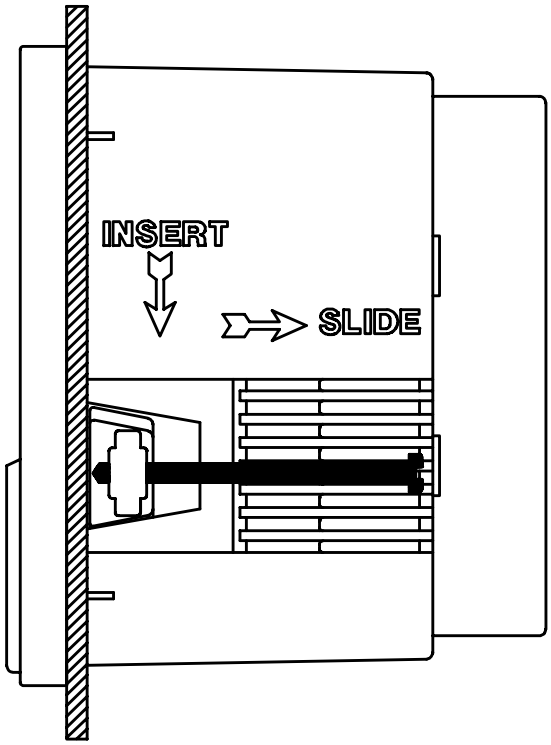


Figure 3.1 Fitting The Meter in a Panel

3.2 CT Connections

The MultiCube is designed for use with external current transformers (CTs). Recommended types should conform to Class 1 per IEC 60044-1. The secondary of the CT should be specified to suit the input rating defined on the meter label. Cables used for the current circuit should have a maximum conductor size of 4.0mm^2 and should be kept as short as possible to reduce cable losses loading the CT secondary.

CT Inputs to the meter are isolated from each other and all other parts of the circuit. This allows use on a wide variety of systems including those requiring common and/or earthed CT secondaries.

WARNING

NEVER leave the secondary of a current transformer open circuit while a primary current flows. In this condition dangerous voltages may be produced at the secondary terminals.

3.3 Voltage Connections

Cables used for the voltage measurement circuit should be insulated to a minimum of 600V AC and have a minimum current rating of 250mA. The maximum conductor size is 4.0mm^2.

External protection fuses are recommended for the voltage measurement inputs. These should be rated at 160mA maximum, Type F, and should be able to withstand voltages greater than the maximum input to the meter.

3.4 Auxiliary Mains Supply (L & N)

The MultiCube uses an isolated auxiliary mains supply separate from the voltage measurement inputs. This may be connected separately or in parallel with the measurement inputs provided the ratings detailed on the instrument label are not exceeded.

Separate connection of the auxiliary mains is required, for example, when :

- A suitable supply voltage is not available locally.
- Measurement voltages are expected to vary over a wide range
- A backup supply is required to maintain meter display

The auxiliary mains supply is internally fused at 250V, 100mA type T. External fusing is required if the auxiliary supply voltage exceeds 250V. The meter ratings are detailed on the instrument label.

WARNING

CHECK the instrument **LABELS** for correct input ratings. Incorrectly rated inputs may permanently damage the device

3.5 Connection Schematics

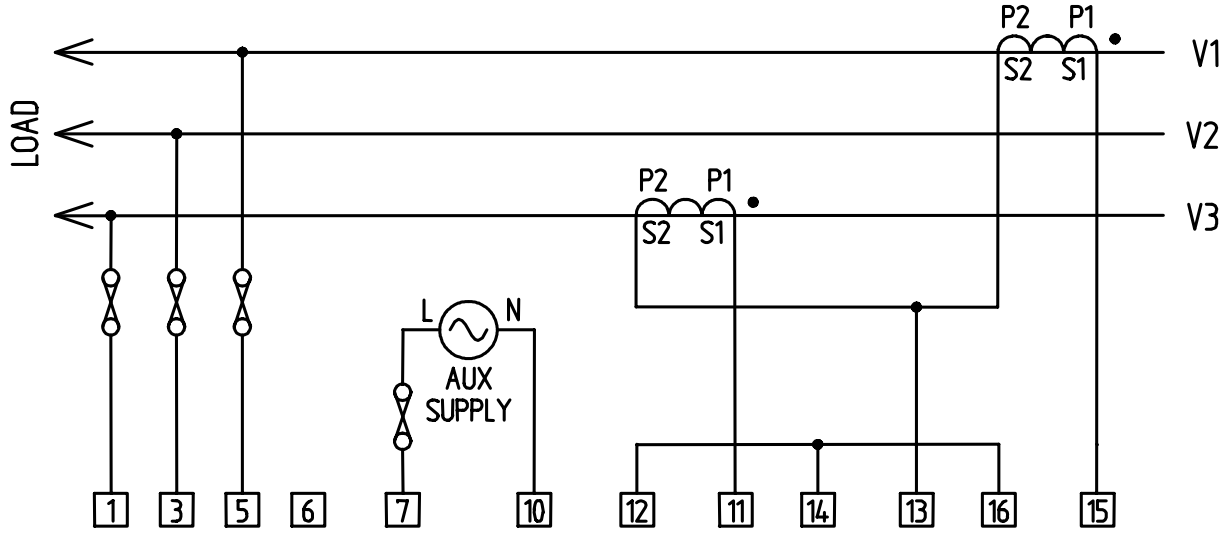


Figure 3.2 3-Phase 3-Wire 2CTs

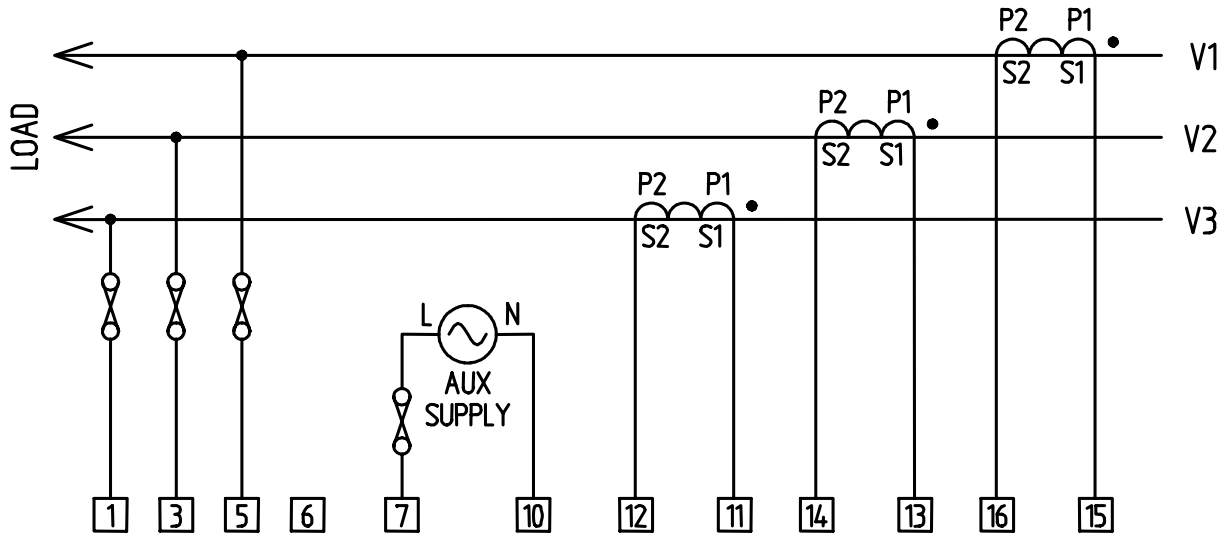


Figure 3.3 3-Phase 3-Wire 3CTs

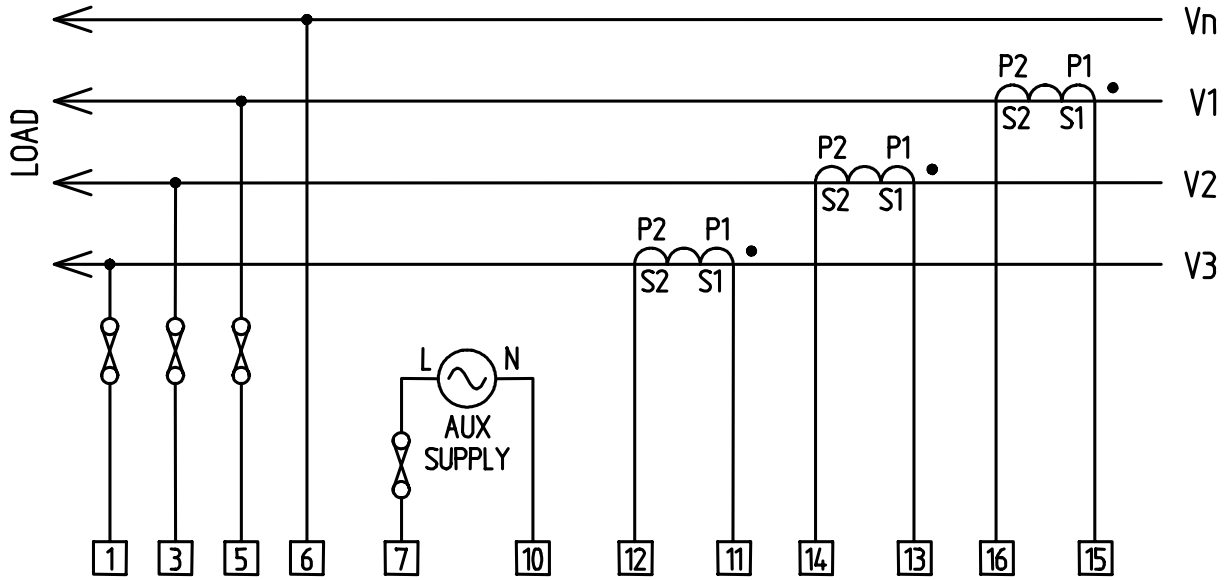


Figure 3.4 3-Phase 4-Wire

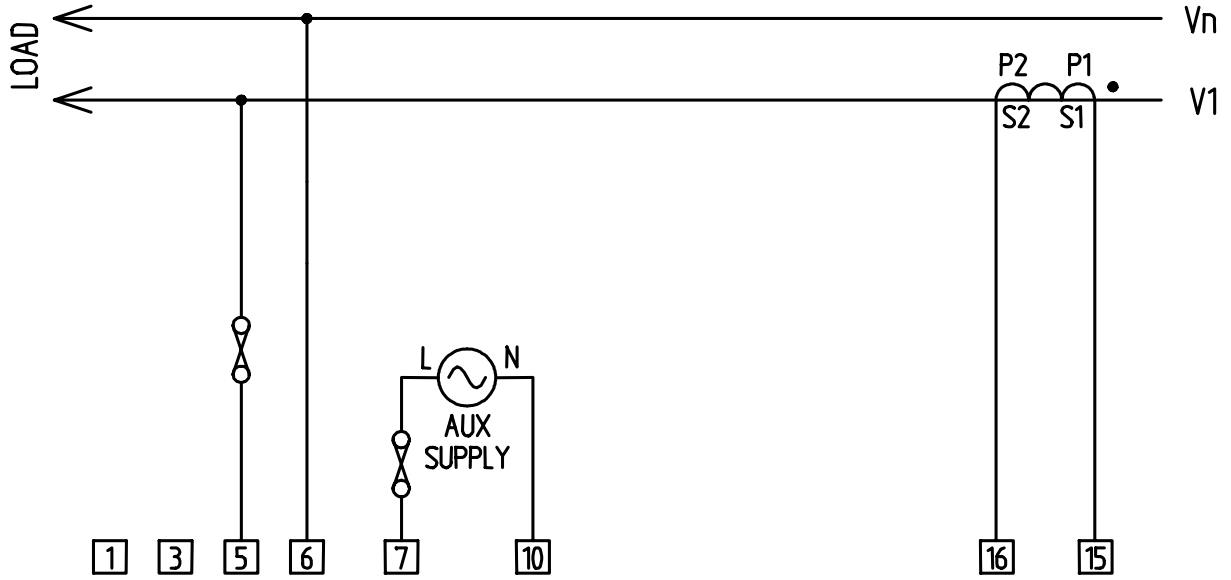


Figure 3.5 Single Phase

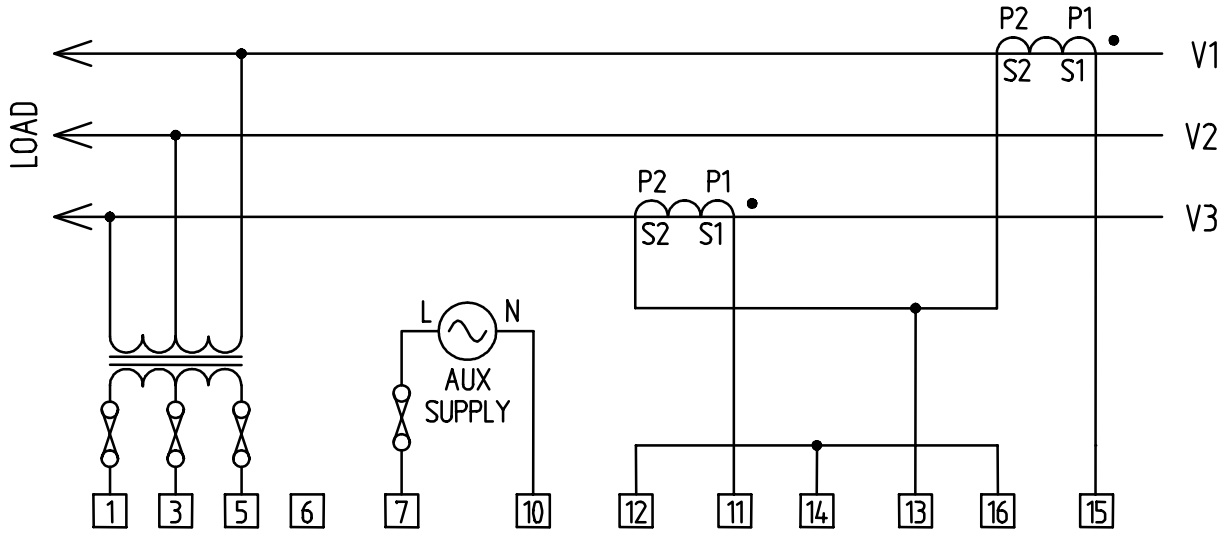


Figure 3.6 3 Phase 3 Wire Using Potential Transformers

3.6 Isolated Pulse Outputs

The MultiCube S incorporates two isolated pulse outputs. These outputs provide a simple interface to external systems such as building management centres etc.

Each output takes the form of a normally open, volt free contact pair which provides a low resistance, for 100mS, at the end of a pre-set number of increments of the associated energy register ('pulse rate'). The pulse rate of each output may be programmed by the user to match the requirements of the external system. For further details on programming the MultiCube refer to Section 4.

Pulse Output #1 provides an output proportional to kWh.

Pulse Output #2 provides an output proportional to total kvarh as standard. This may be factory set to pulse in proportion to kVAh if required.

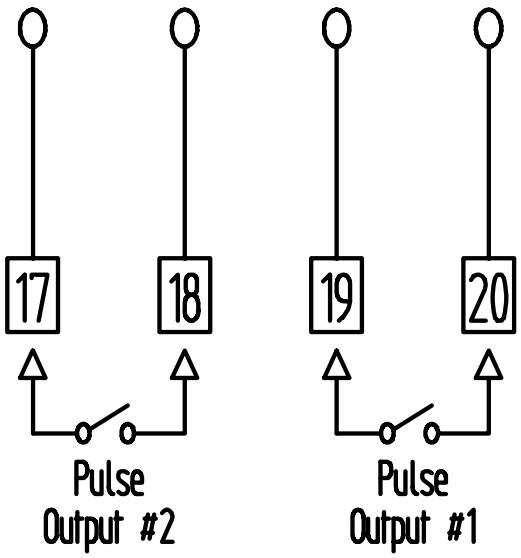


Figure 3.7 Pulse Output Connection

4. Programming

4.1 Description

The MultiCube is designed for use in a wide variety of systems. A range of programmable features allow the unit to be set-up for a specific application. Programming is available using the front panel keypad and display while the unit is operational.

4.2 Entering and Exiting Programming Mode

To enter programming, Press I/V and P together and hold for 5 seconds.

When all user programmable settings are complete, Press I/V and P together and hold for 5 seconds to return to measurement mode.

4.3 Setting The CT Primary Current

The first item in the programming menu allows the user to set the CT Primary current, in the range 5A to 20000A, to match the primary of the current transformers connected to the meter inputs. The secondary of the CTs must match the nominal input current specified on the meter label. Once set, the constant acts as a multiplying factor in the internal calculation of relevant measurements.

Figure 4.1 Setting The CT Primary Constant

Press △ to increase the CT Primary Constant in steps of 1 Amp.

Press ▽ to decrease the CT Primary Constant in steps of 1 Amp.

Press ↵ and hold for 2 seconds when done.

4.4 Setting The PT Primary Voltage

The next item in the programming menu allows the user to set the PT Primary line-line voltage, in the range 60V to 50,000V, to match the primary of the potential transformers connected to the meter inputs. The secondary of the PTs must match the nominal line-line input voltage specified on the meter label. If no potential transformers are fitted the PT setting must match the nominal line-line input voltage specified on the meter label.

Figure 4.1 Setting The PT Primary Constant

Press △ to increase the PT Primary Constant in steps of 1 Volt.

Press ▽ to decrease the PT Primary Constant in steps of 1 Volt.

Press ↵ and hold for 2 seconds when done.

4.5 Setting Pulse Output 1 Rate

Isolated pulse output #1 may be set to provide a single pulse at the end of every 1, 10, or 100 increments of the Wh register irrespective of display scaling and decimal point. This allows the unit to be configured to suit a wide variety of data logging, building management type applications.

During programming, the Pulse Output #1 Rate is displayed scaled as the Wh register for convenience. A display of ***PL 1 rAtE 10.0 kWh*** indicates that a single pulse will occur, at output #1, at the end of each 10 kWh.

Figure 4.2 Setting The Pulse Output #1 Rate

Press △ to increase the Pulse Output Rate by a factor of 10.

Press ▽ to decrease the Pulse Output Rate by a factor of 10.

Press ↵ and hold for 2 seconds when done.

4.6 Setting Pulse Output 2 Rate

Isolated pulse output #2 may be set to provide a single pulse at the end of every 1, 10, or 100 increments of the Total varh register irrespective of display scaling and decimal point. This allows the unit to be configured to suit a wide variety of data logging, building management type applications.

During programming, the Pulse Output #2 Rate is displayed scaled as the total varh register for convenience. A display of ***PL 2 rAtE 10.0 kVArh*** indicates that a single pulse will occur, at output #2, at the end of each 10 kvarh.

Figure 4.3 Setting The Pulse Output #2 Rate

Press △ to increase the Pulse Output Rate by a factor of 10.

Press ▽ to decrease the Pulse Output Rate by a factor of 10.

Press ↵ and hold for 2 seconds when done.

Note: Pulse Output #2 may be factory set to pulse in proportion to kVAh. The display page shown above will reflect this setting.

5. Options Module

5.1 Description

A range of retro-fit options modules are available for the MultiCube. These provide additional features to the meter such as serial communications, analogue outputs, alarms etc. A single options module may be mounted to the rear of the MultiCube as shown.

For detailed information on individual options modules refer to the separate Instruction manual.

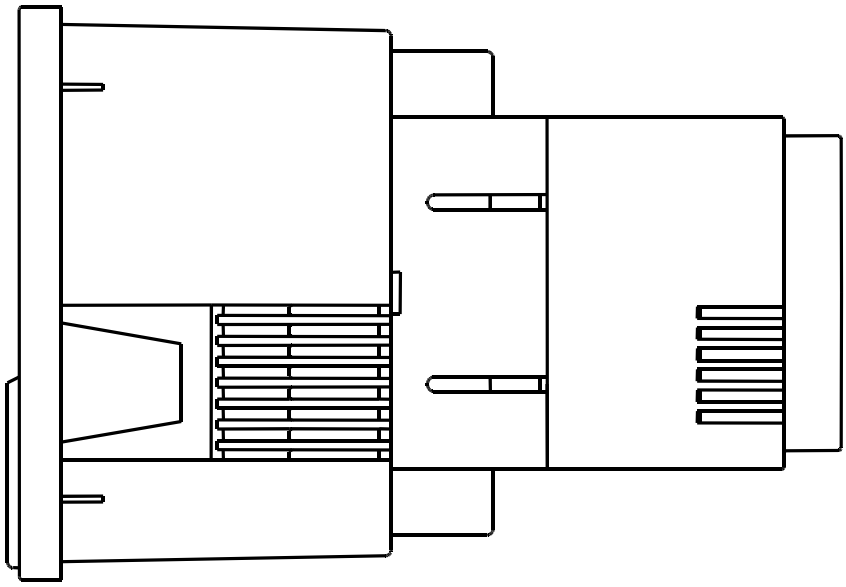


Figure 5.1 Options Module Attached to MultiCube

6. Specification

Inputs	
System	3-Phase 3 or 4 Wire Unbalanced Load
Voltage	Vb. 230 / 400 Volt. 3-Phase 3 or 4 Wire Vb. 63 / 110 Volt optional Vb. 120 / 208 Volt optional
Current	Ib 5 Amp from external current transformers (CTs) Ib 1 Amp optional Fully Isolated (2.5kV each phase)
Measurement Range **Voltage** **Current**	 20% to 120% 0.5% to 120%
Frequency Range **Fundamental** **Harmonics**	 45 to 65Hz Up to 20th harmonic
Input Loading **Voltage** **Current**	 Less than 0.1 VA per phase Less than 0.1 VA per phase
Overloads **Voltage** **Current**	 x2 for 2 seconds maximum x40 for 0.5 seconds maximum

Auxiliary Supply	
Standard	230 Volt 50/60Hz ±15%
Options	110 Volt 50/60Hz ±15%. (Others to order)
Load	5 VA Maximum

Accuracy	
Phase Current	0.2% Ib (1.0% Rdg. 0.05 Ib ≤ I_{ph} ≤ 1.2 Ib) ±1 digit.
Neutral Current	0.6% Ib (2.0% Rdg. 0.05 Ib ≤ I_n ≤ 1.2 Ib) ±1 digit.
Phase Voltage	0.2% Vb (1.0% Rdg. 0.2 Vb ≤ V_{ph} ≤ 1.2 Vb) ±1 digit.
Line-Line Voltage	0.3% Vb (1.0% Rdg. 0.2 Vb ≤ V_{LL} ≤ 1.2 Vb) ±1 digit.
Phase Watts	0.4% FS (1.0% Rdg. 0.05FS ≤ P ≤ 1.2FS) ±1 digit.
Phase VA	0.6% FS (1.5% Rdg. 0.05FS ≤ Q ≤ 1.2FS) ±1 digit.
Phase var	0.8% FS (2.0% Rdg. 0.05FS ≤ S ≤ 1.2FS) ±1 digit.
Phase PF	± 0.2 Degrees
System Watts	0.6% FS (1.0% Rdg. 0.05FS ≤ P ≤ 1.2FS) ±1 digit.
System VA	1.0% FS (1.5% Rdg. 0.05FS ≤ Q ≤ 1.2FS) ±1 digit.
System var	1.5% FS (2.0% Rdg. 0.05FS ≤ S ≤ 1.2FS) ±1 digit.
System PF	± 0.2 Degrees
Frequency	±0.05Hz. 45Hz ≤ F ≤ 65Hz
Wh Register	Class 1.0 EN 61036
VAh Register	Class 2.0
varh Registers	Class 2.0 IEC 1268
Timebase	Better than 100ppm

Display	
Display Type	Custom, supertwist, LCD with LED backlight
Data Retention	10 years minimum Stores energy registers, user settings, and peaks
Display Format	3 Lines 12mm digits + 3.8mm custom legends
Display Update	1 second

Digital (Pulse) Outputs	
Function	1 pulse / energy unit (Output #1=N Wh, Output #2=N varh)
Scaling	Settable 1,10 or 100 counts of associated register
Pulse Period	100ms. (2ms Rise, 2ms Fall)
Type	N/O Volt free contact. Optically isolated BiFET
Contacts	100mA AC/DC max, 100V AC/DC max
Isolation	2.5kV (50V #1 to #2)

General	
Temperature	
Operating	-10 deg C to +65 deg C
Storage	-25 deg C to +70 deg C
Environment	IP40
Humidity	<75% non-condensing

Mechanical	
Enclosure	DIN 96mm x 96mm Mablex ULV94-V-O
Dimensions	96mm x 96mm x 80mm (72mm behind panel) 130mm behind panel with options unit fitted
Weight	Approx. 400g
Terminals	Rising Cage. 4.0mm^2 cable max

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