Operating Manual
July 2006
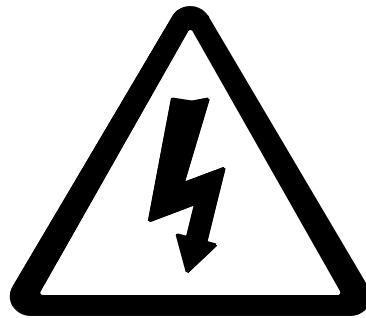
1 Safety

This instruction sheet gives details of safe installation and operation of the *Cube350* electricity meter. Safety may be impaired if the instructions are not followed. Labels on each meter give details of equipment ratings for safe operation. Take time to examine all labels before commencing installation. Safety symbols on the meter have specific meanings.

Refer To User Manual   **Risk of Electric Shock**

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

Further information is available at http://www.ndmeter.co.uk.

2 Operation

2.1 Energy Displays

Press **kWh ▼** to select kWh kvarh and Hours Run display pages.

Active Energy Register

Reactive Energy Register

Hours Run

The Hours Run register accumulates the total time during which the average 3-phase load current exceeds a preset level. This is always displayed with a resolution of 0.1hour.
The percentage level of (I1+I2+I3) at which the Hours Run register accumulates is user programmable from 1% to 100% of full scale current.

Press **kW ▲** and **kWh ▼** together and hold for 2 seconds to reset the hours run register.
Scaling of the energy registers is set by the nominal input currents and voltages and remains constant during operation of the meter. Energy registers will each accumulate from zero to 99,999,999 then restart from zero.

2.2 Voltage Displays

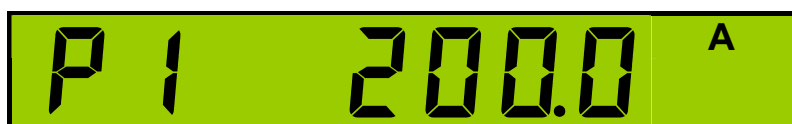Press **V** to select from the following displays;

Phase-n Voltages 1 - 3

Line-Line Voltages 1 – 3

2.3 Current Displays

Press **I ◄** to select from the following displays;

Phase 1 – 3 Current

Operation

2.4 Power Displays

Press **kW** ▲ to select from the following displays;

144.00 kW

System Active Power

PFc   1.00

System Power Factor (C=Capacitive)

F   50.0

Frequency. Hz (Phase 1 voltage)

P1   48.00 kW

Phase 1-3 Active Power

PF1c   1.00

Phase 1-3 Power Factor (C=Capacitive)

2.5 Phase Healthy Indicators

Three LEDs indicate when the individual phase-neutral voltages are present. These will illuminate when the measured voltage is above 80% of the nominal value. Below this level the LEDs will be off.

L1   L2   L3

Phase Healthy LEDs

2.6 Pulse Outputs

Two isolated pulse outputs are provided for connection to external systems such as Building Energy Management Systems (BEMS), data loggers, remote counters etc. Pulse 1 is associated with the active energy (kWh) register and Pulse 2 with the reactive energy (kvarh) register. A single pulse occurs for each unit of energy on the display (eg 1 pulse per 0.1kWh). The pulse rate (amount of energy associated with each pulse) and pulse length may be set to suit the external system.

2.6.1 Pulse LEDs

Light emitting diodes (LEDs) on the front panel of the instrument remain ON during each associated output pulse.

Pulse Output Indicators

3 Specification

INPUTS

System	3 Phase 3 or 4 Wire Unbalanced Load	
Voltage Un	400/230V. 3 Phase 3 or 4 Wire	
	110/63V & 208/120V optional. Others to order.	
Current In	5A from external CTs. 1A optional. Fully isolated	
Measurement	Voltage	50% to 120%
Range	Current	0.2% to 120%
Frequency Range	Fundamental	45 to 65Hz
	Harmonics	Up to 30th harmonic at 50Hz
		Individual to the 15th
Burden	Voltage	<0.1VA per phase
	Current	<0.1VA per phase
Overload	Voltage	x4 for 1 hour
	Current	x40 for 0.5 second max

DISPLAY

Type	Custom, Supertwist, LCD
Data Retention	10 years min. Stores kWh & Meter set-up
Format	8 x 6.66mm high digits with DPs & 3.2mm legends
Scaling	Direct reading. User programmable CT & VT
	CT Primary programmable from 10A to 25kA
	VT primary programmable from 11V to 55kV
Legends	Wh, kWh, MWh etc. depending on user settings

AUXILIARY SUPPLY

Standard	230V 50/60 Hz ±15%
Options	110V 50/60 Hz ±15%
Load	2VA max.
Overload	x1.2 continuous

ACCURACY All errors ± 1 digit

kWh	Better than Class 1 per EN 62053-21 & BS 8431
Kvarh	Better than Class 2 per EN 62053-23 & BS 8431
kW & kVA	Better than Class 0.25 IEC 60688
kvar	Better than Class 0.5 IEC 60688
Amps & Volts	Class 0.1 IEC 60688 (0.01In – 1.2In or 0.1Un – 1.2Un)
PF	±0.2° (0.05In – 1.2In and 0.2Un – 1.2Un)
Neutral Current	Class 0.5 IEC 60688 (0.05In – 1.2In)

PULSE OUTPUTS

Function	1 Pulse per unit of energy
Scaling	Settable between 1 & 1000 counts of kWh register
Pulse Period	0.1 sec. default; Settable between 0.1 and 20 sec
Rise & Fall Time	< 2.0ms
Type	N/O Volt free contact. Optically isolated BiFET
Contacts	100mA ac/dc max., 100V ac/dc max.
Isolation	2.5kV 50Hz 1 minute

MODBUS® Serial Comms

Bus Type	RS485 2 wire + 0v. ½ Duplex, ¼ unit load
Protocol	MODBUS® RTU with 16 bit CRC
Baud Rate	4800, 9600 or 19,2000 User settable
Address	1 – 247 User settable
Latency	Reply within 250ms max.
Command Rate	New command within 5ms of previous one

GENERAL

Temperature	Operating	-10°C to +65°C
	Storage	-25°C to +70°C
Humidity	< 75% non-condensing	
Environment	IP54 standard, IP65 optional	

MECHANICAL

Terminals	Rising Cage. 4mm2 (12 AWG) cable max.
Enclosure	DIN 43700 96 x 96
Material	Mablex® with fire protection to UL94-V-O. Self extinguishing
Dimensions	96 x 96 mm x 83.5 mm (72 mm behind panel)
Weight	~ 250 gms

SAFETY

Conforms to	EN 61010-1 Installation Category III

4 Programming

4.1 Programming Menu

To enter programming mode:

Hold [I ◄] and [V] together for 5 Seconds.
A *Security Code* may be required before changes to programmed parameters are allowed. This is only required if a *Security Code* greater than zero is set via serial communications. This is then stored in non-volatile memory during power interruptions.

4-Digit Security Code

To Enter A Security Code:

Press [kW ▲] or [kWh ▼] to change each digit. (Lowest significant digit first).

Press [I ◄] to select next most significant digit.

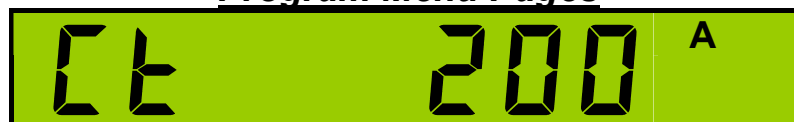### *When a valid code is input the programming menu is displayed.*

To change a Programmable Value:

Press [kW ▲] or [kWh ▼] until the required value is set.
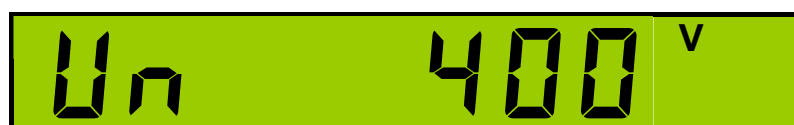
To Move to The Next Setting:

Press [I ◄] until the next page in the list is displayed. Parameters are set in the following order:

Program Menu Pages

Current Transformer Primary

Nominal Line-Line V (or PT Primary)

Output Pulse Rate

Pulse On Time

Pulse Output Test

Hours Run Trip Point (Percent Amps)

Changes Are Stored to Non-Volatile Memory

After the last parameter is set the new values are stored and the meter continues to measure with the new settings.

4.2 Fine Adjust

CT Primary and Nominal Voltage settings are selected from a table of preferred values. This reduces the time to program these parameters to industry standard values.

Fine Adjust Mode allows values other than those provided by the default tables to be set. To enter/exit *Fine Adjust Mode:*

Hold **kW ▲** and **I ◄** together for 2 Seconds while setting *CT* or *Un*.

Fine Adjust Mode is indicated by a decimal point immediately after the parameter type (ie*. "CT."* or *"Un."*)

4.3 CT Preferred Values Table (Amps)

10,50,60,100,150,200,250,300,400,500,600,800,
1000,1200,1250,1500,1600,2000,2400,2500,3000,
3500,4000,4500,5000,5500,6000,6500,7000,7500,
8000,8500,9000,9500,10000,10500,11000,11500,
12000,12500,13000,13500,14000,14500,15000,15500,
16000,16500,17000,17500,18000,18500,19000,19500,
20000,20500,21000,21500,22000,22500,23000,23500,
24000,24500,25000

4.4 PT Preferred Values Table (Volts)

11,40,48,100,110,208,400,480,600,800,1000,1100,2200,3300,4000,
4400,5000,7500,10000,11000,15000,22000,25000,33000,40000
44000,55000

4.5 Pulse Rate Selection Table (Counts)

1,2,5,10,100,1000

4.6 Pulse On-Time Selection Table

100ms,200ms,500ms,1s,2s,3s,5s,10s,20s

4.7 Pulse Output Test

This feature allows the pulse output hardware and external system connections to be commissioned without a measured load. The LCD shows *Pto* (off) and *Ptr* (run) and the number of test pulses. The test pulse rate is set automatically dependant on the programmed pulse length (maximum 0.5Hz).

Press **kW ▲** to start/stop the test pulses on both outputs.

Press **kW ▲** and **kWh ▼** together to stop the test pulses and simultaneously reset the test counter.

5 Display Scaling

The units, Wh, kWh or MWh and the position of the decimal point for the energy/power displays are automatically set dependant on the *CT* and *Un* settings for the meter.

The nominal 3-phase input for the meter is defined as:

$$Wnom = \sqrt{3} \ \times \ Un \ \times \ CT$$

Where: *Un* is the nominal Line-Line voltage or PT primary (10V - 55kV).
   CT is the current transformer nominal primary (10A – 25kA)
   Un and *CT* are set in programming mode.

The display pages are scaled as follows:

CT	Amps Resolution
< 80 A	0.01 A
< 800 A	0.1 A
< 8,000A	1 A
> 8,000A	0.01 kA

Un	Volts Resolution
<= 90 V	0.01 V
<= 1200 V	0.1 V
<= 9,000 V	0.001 kV
> 9,000 V	0.01 kV

*W*_{nom}	kW/kvar Resolution	kWh/kvarh Resolution
< 243 W	0.1W (var)	0.001 kWh (kvarh)
< 2.43 kW	0.1W (var)	0.001 kWh (kvarh)
< 24.3 kW	0.001 kW (kvar)	0.01 kWh (kvarh)
< 243 kW	0.01 kW (kvar)	0.1 kWh (kvarh)
< 2.43 MW	0.1 kW (kvar)	1 kWh (kvarh)
< 24.3 MW	1 kW (kvar)	0.01 MWh (Mvarh)
< 243 MW	0.01 MW (Mvar)	0.1 MWh (Mvarh)
> 243 MW	0.1 MW (Mvar)	1 MWh (Mvarh)

6 Installation

6.1 Mounting In a Panel

Panels should be 1mm to 4mm thick with a square cutout of 92mm (+0.8/-0.0mm). Insert the meter from the front of the panel, slide the panel clips from the rear of the case and push firmly against the panel ensuring even pressure on each clip.

6.2 Pulse Output Connection

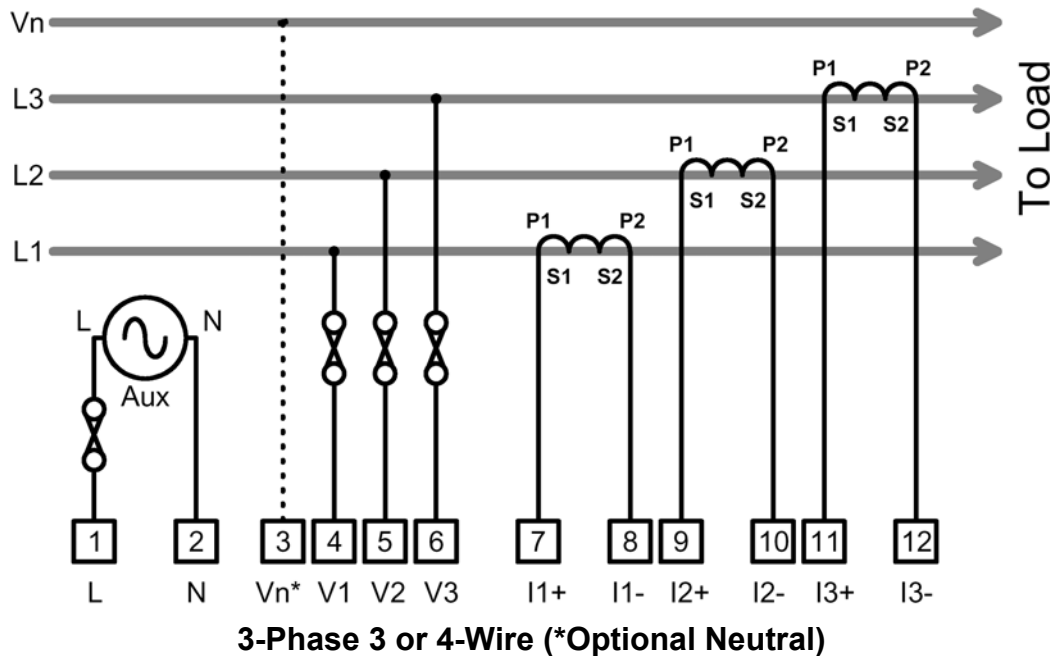The pulse outputs take the form of isolated volt free normally open contact pairs.

The contacts are isolated from all other circuits (2.5kV / 1 minute) and at 50V from pulse1 to pulse 2.

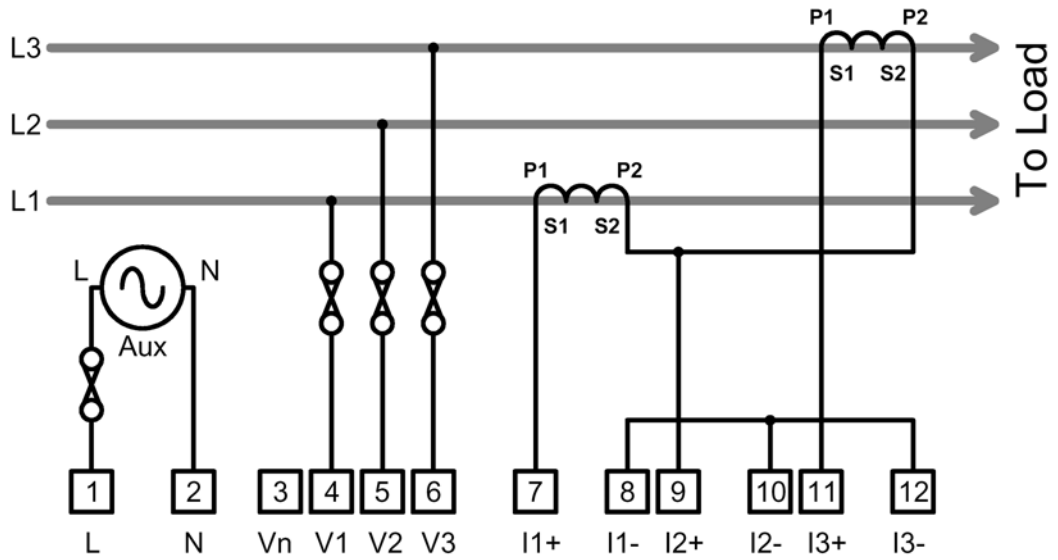The pulses can be used as an input to a remote counter, pulse logger, building energy management system etc.
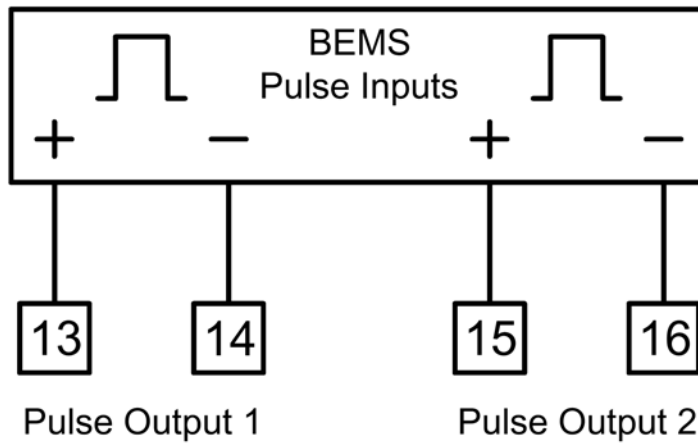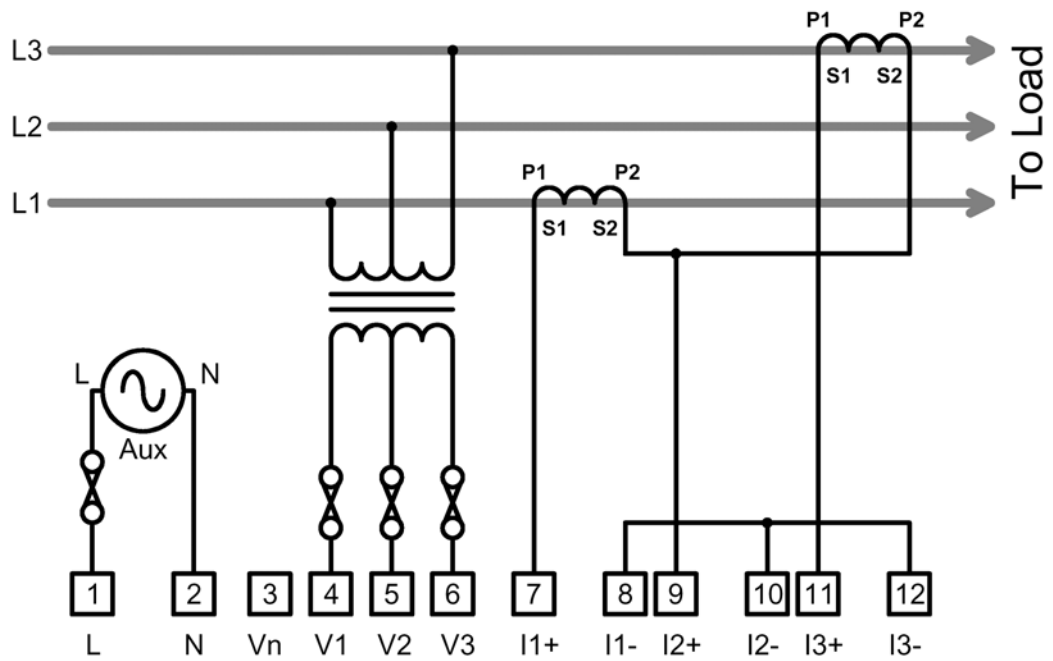

Pulse Output Connections
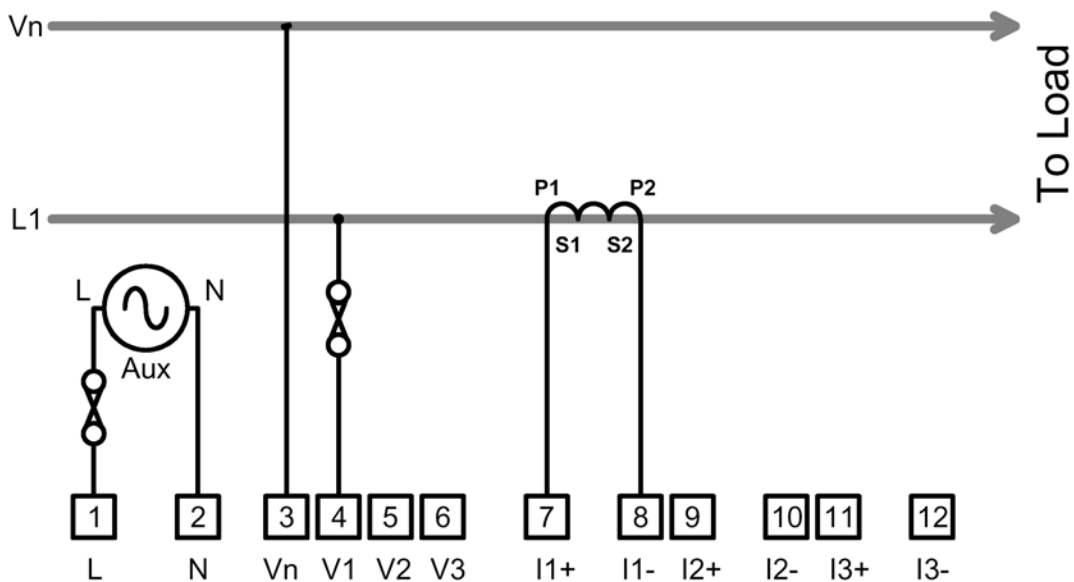
6.3 Standard Connections

3-Phase 3 or 4-Wire (*Optional Neutral)

3-Phase 3-Wire

3-Phase High Voltage (HV)

Single Phase