

Cube350V Operating Manual

Current Sensor Inputs

April 2008

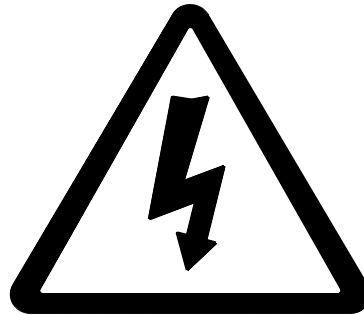


1 Safety

This instruction sheet gives details of safe installation and operation of the **Cube350V** 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

WARNING


Risk of Electric Shock

Isolate all inputs and supplies to the meter before connecting the current sensors on the load cables or wiring the sensors to the meter.

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

2 Operation

2.1 Energy Displays

Press  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  and  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  to select from the following displays;




Phase-n Voltages 1 - 3



Line-Line Voltages 1 - 3

2.3 Current Displays


Press  to select from the following displays;



Phase 1 - 3 Current

Operation

2.4 Power Displays

Press  to select from the following displays;



System Active Power



System Power Factor (C=Capacitive)



Frequency. Hz (Phase 1 voltage)



Phase 1-3 Active Power



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.



Phase Healthy LEDs

Operation

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 Programming

3.1 Programming Menu

To enter programming mode:



Hold  and  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  or  to change each digit. (Lowest significant digit first).

Press  to select next most significant digit.

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

To change a Programmable Value:

Press  or  until the required value is set.

To Move to The Next Setting:

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

Program Menu Pages



Current Sensor 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.

3.2 Current Sensor Type Selection (CT)

Current sensor types are selected from a table of preferred types identified by their nominal primary current rating. The following types may be selected.

5, 50, 100, 150, 400, 800.

Note: Current sensors **MUST** be from the Cube350V range of input devices supplied by the manufacturer. Use of other sensors may affect accuracy & safety

3.3 Nominal Line-Line Voltage Selection (Un)

The nominal line-line voltage of the measured supply system may be programmed.



For systems without potential transformers (PTs) this should be the same as the nominal input of the meter as specified on the rating label (e.g. 400V).

For systems with PTs fitted this should match the nominal primary rating of the PT. The preferred values are:

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

3.3.1 Fine Adjust

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

Hold  and  together for 2 Seconds while setting **Un**. **Fine Adjust Mode** is indicated by a decimal point after "Un".

3.4 Pulse Rate Selection Table (Counts)


1, 2, 5, 10, 100, 1000

3.5 Pulse On-Time Selection Table

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

3.6 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  to start/stop the test pulses on both outputs.

Press  and  together to stop the test pulses and simultaneously reset the test counter.

4 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:

$$W_{nom} = \sqrt{3} \times Un \times CT$$

Where: **Un** is the nominal Line-Line voltage or PT primary (10V - 55kV).
CT is the current sensor nominal primary (5A – 800A)
Un and **CT** are set in programming mode.

The display pages are scaled as follows:

CT	Amps Resolution
5A	0.01 A
50A	0.01 A
100 A	0.1 A
150A	0.1 A
400A	0.1 A
800A	1 A

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)

5 Installation

5.1 Mounting In a Panel

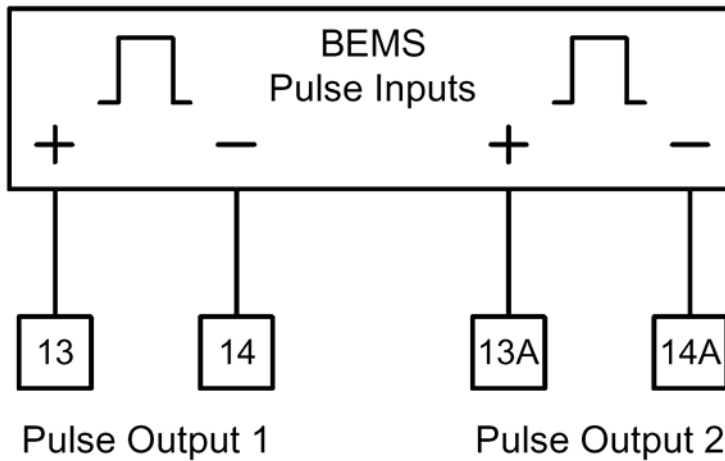
Panels should be 1mm to 4mm thick with a square cutout of 92mm (+0.8/-0.0mm). Insert the meter from the front of the panel, slide the panel clips from the rear of the case and push firmly against the panel ensuring even pressure on each clip.

5.2 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

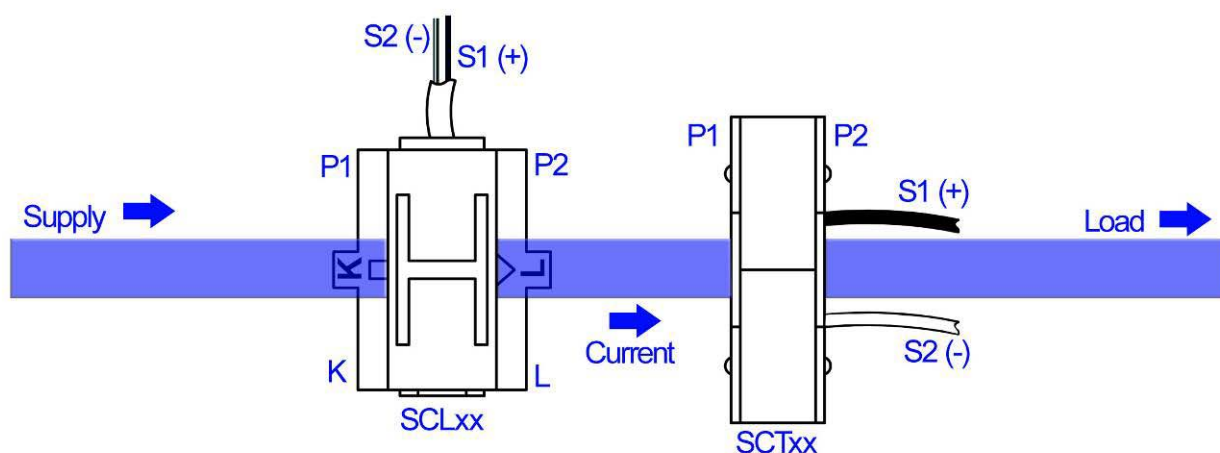
5.3 Using Current Sensors

WARNING
Risk of Electric Shock

Isolate all inputs and supplies to the meter before connecting the current sensors on the load cables or wiring the sensors to the meter.

5.3.1 Current Sensor Polarity

The current sensors MUST be placed on the load cable with the correct polarity. The following diagram shows how each device is fitted on the cable for correct operation:



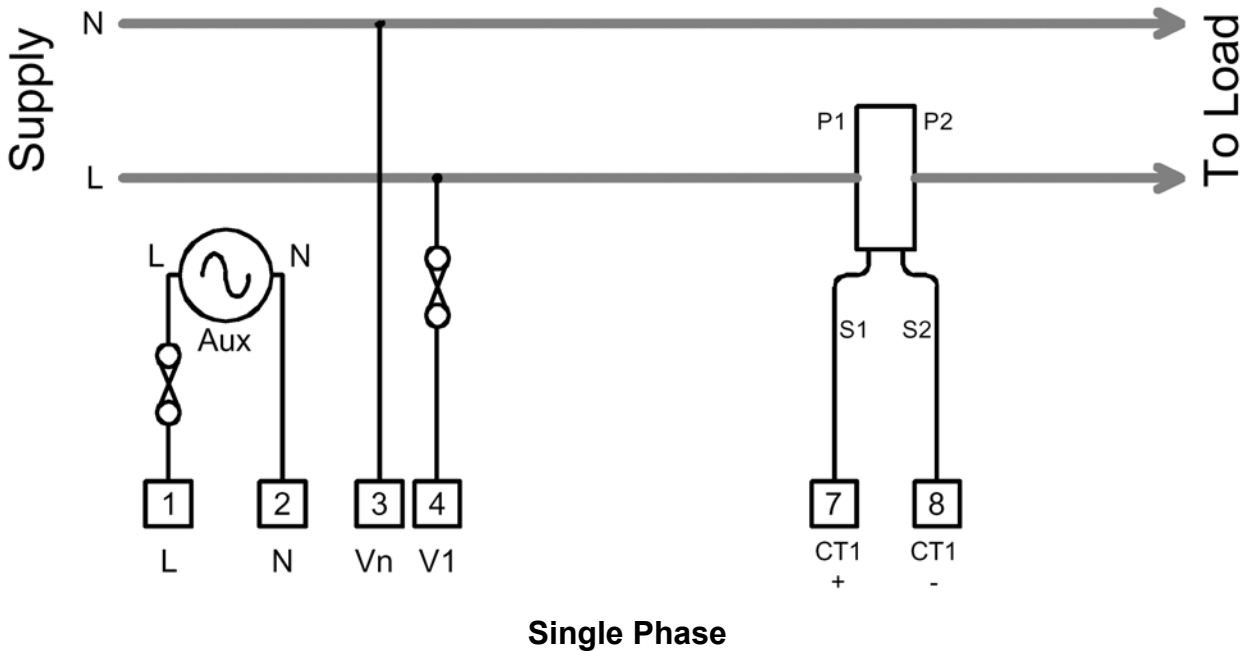
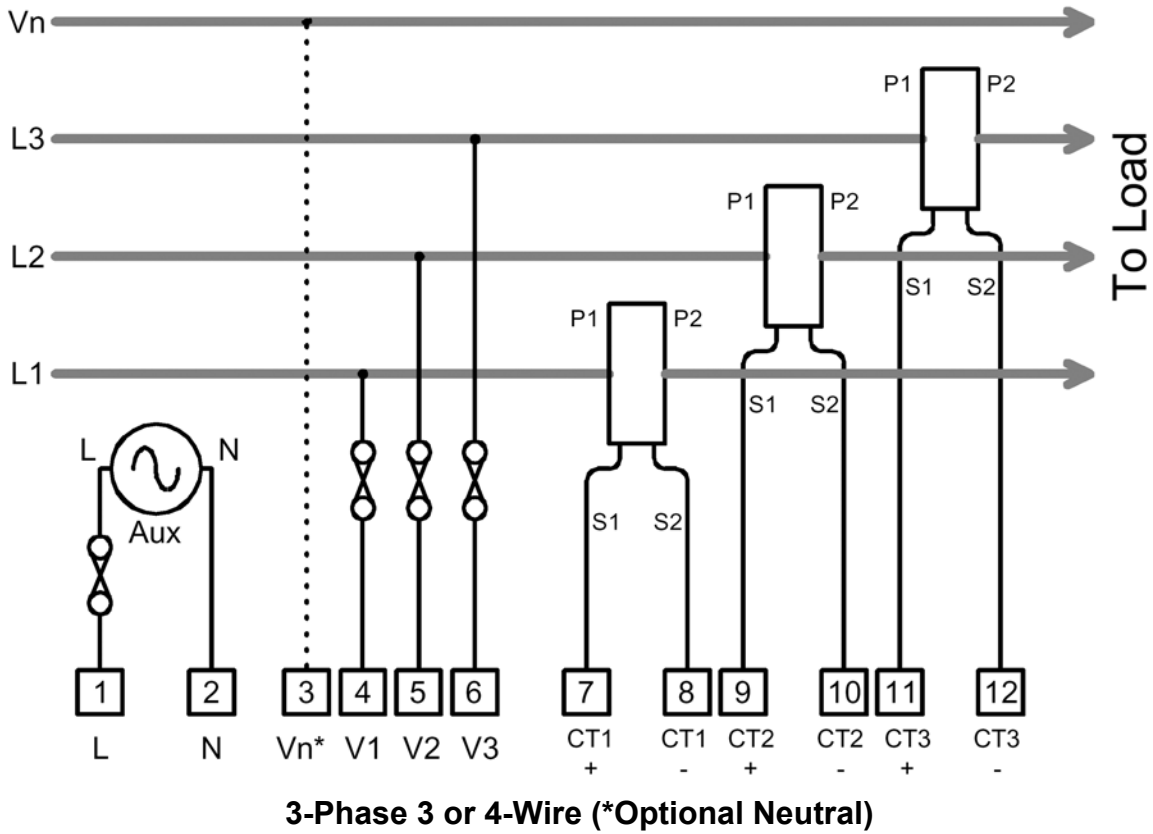
NOTE: If a current sensor is placed on the cable in the opposite orientation the associated phase kW reading will be negative.

The secondary cables also require wiring with correct polarity. The white cable (or black/white) is the negative and should be connected to S2 or CT- on the meter. The black cable is the positive and should be connected to S1 or CT+ on the meter.

NOTES:

- The output from these current sensors is a low voltage. It is safe to leave these outputs open-circuit if not connected to a meter.
- The output connections from these current sensors must be individually wired direct to the meter and must not be earthed or connected to any other circuit.
- If the sensor secondary cables require extending, use of screened twisted pair cable, not exceeding 5m in length, is recommended to reduce the effects of electrical interference. This cable must have an insulation rating >250V.

6 Standard Connections



7 Specification

INPUTS	
System Voltage Un	3 Phase 3 or 4 Wire Unbalanced Load 400/230V. 3 Phase 3 or 4 Wire 110/63V & 208/120V optional. Others to order.
Current Sensors	
Output @ Nominal In	0.333Vac
Accuracy	±1% (0.1In – 1.2In)
ND SCL8-5	In = 5A; Max Cable = 8mm Dia. Phase Error <2.5° at 0.5In
ND SCL16-50	In = 50A; Max Cable = 16mm Dia. Phase Error <2.5° at 0.5In
ND SCL16-100	In = 100A Max Cable = 16mm Dia. Phase Error <2° at 0.5In
ND SCT19-150	In = 150A Max Cable = 19mm Dia. Phase Error <2° at 0.5In
ND SCT32-400	In = 400A; Max Cable = 32mm Dia. Phase Error <2° at 0.5In
ND SCT51-800	In = 800A; Max Cable = 51mm Dia. Phase Error <2° at 0.5In
Enclosures	UL94V-0
Insulation	>300Vrms, CAT III
Environment	Indoor use only (Altitude < 2000m)
Measurement Range	Voltage 50% to 120% Current 0.2% to 120%
Frequency Range	Fundamental 45 to 65Hz Harmonics Up to 30th harmonic at 50Hz Individual to the 15th
Voltage Burden	<0.1VA per phase
Overload	Voltage x4 for 1 hour Current SCL x10 for 1min SCT19 200A Continuous SCT32 800A Continuous SCT51 2000A Continuous
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 & PT 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
METER 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)

Specification

OVERALL METERING ACCURACY		
ND SCL8-5	5 Amp	Better than Class 2 Meter with Class 1 CTs
ND SCL16-50	50 Amp	Better than Class 1 Meter with Class 1 CTs
ND SCL16-100	100 Amp	Better than Class 1 Meter with Class 1 CTs
ND SCT19-150	150 Amp	Better than Class 1 Meter with Class 1 CTs
ND SCT32-400	400 Amp	Better than Class 1 Meter with Class 1 CTs
ND SCT51-800	800 Amp	Better than Class 1 Meter with Class 1 CTs
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 ; 5W maximum load	
Isolation	2.5kV 50Hz 1 minute	
MODBUS® Serial Comms (Option)		
Bus Type	RS485 2 wire + 0v. ½ Duplex, ¼ unit load	
Protocol	MODBUS® RTU with 16 bit CRC	
Baud Rate	4800, 9600 or 19,200 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. 4mm ² (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	

E. & O. E.

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