Cube400
Installation Guide
November 2013

1 Safety

This instruction sheet gives details of safe installation and operation of the ***Cube400*** electricity meter. 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 as:

Caution Risk of Danger
Refer to Instructions

Danger
Risk of Electric Shock

Safety may be impaired if the instructions are not followed or the meter is used in a manner not specified by the manufacturer.

Contains no user serviceable parts. Field wiring and commissioning should only be carried out by qualified personnel, in compliance with applicable national regulations.
e.g. National Electrical Code (NEC) for US; Canadian Electrical Code for Canada

For further Information contact the manufacturer:
Address: Northern Design (Electronics) Ltd: 228 Bolton Road, Bradford, West Yorkshire, BD3 0QW. (UK)
Web: http://www.ndmeter.co.uk

2 Maintenance

The equipment should be maintained in good working order. Damaged equipment must be sent to the manufacturer (or his authorised agent) for repair. 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.

3 Intended Use

The ***Cube400*** is a precision multi function electricity monitor which measures system power parameters, including kW, Volts and Amps and displays them on an LCD. Measured parameters may be sent to remote systems for storage or display using an optional communications interface (e.g. Modbus® RTU RS485 or Ethernet).
The ***Cube400*** is intended for mounting in the faceplate (panel) of an electrical enclosure with only the front keypad/display panel remaining accessible to an operator after installation. Panels should be 1mm to 4mm (0.04” to 0.16”) thick with a square cut-out of 92mm (+0.8/-0.0mm) (3.62” +0.03” -0”). 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.

The safety of any system containing the meter as a component remains the responsibility of the system manufacturer. After installation in a system, the ratings of the overall system, which reflect the ratings of the meter, must be visible to the user.

A suitably located and easily reached switch or circuit breaker must be included as part of the installation. This could, for example, be a safety-interlocking device on the door/front panel of the electrical enclosure. This switch/circuit breaker must be marked as the disconnecting device for the equipment and must comply with the relevant requirements of IEC 60947-1 and IEC 60947-3.

Disconnect / Isolate all supplies before commencing installation.

4 Standard Connections

4.1 Current Connections

4.1.1 Current Cables

Current cables must be rated for safe use in the electrical enclosure which houses the meter (e.g. UL1015) and must meet the following minimum specification: Temperature: 105°C (221°F); Insulation 600Vac.

4.1.2 Current Terminals

Voltage:	30Vac maximum
Cable:	22-14 AWG, Stripped 5.5 to 6.5mm (0.2” to 0.25”)
Torque:	0.5Nm (4.4in lb)

4.2 Voltage Connections

To maintain proper insulation from the mains supply, the neutral wire should only be used in power networks where the system neutral is protectively earthed

4.2.1 Voltage Cables

Voltage cables must be rated for safe use in the electrical enclosure which houses the meter (e.g. UL1015) and must meet the following minimum specification: Temperature: 105°C (221°F); Insulation 600Vac.

4.2.2 Auxiliary Mains Supply

The meter is powered from an auxiliary mains supply which is required to energise the metering circuit and display. This can be connected in parallel with one of the measurement phase voltages if it is rated correctly.

Ensure the auxiliary mains supply L-N is powered from a correctly rated and fused AC source as specified on the meter label.

4.2.3 Voltage Terminals

Voltage:	277Vac (3-4) 480Vac (4-5, 5-6)
Cable:	30-14 AWG, Stripped 5.5 to 6.5mm (0.2” to 0.25”)
Torque:	0.5Nm (4.4in lb)

4.2.4 Voltage Fuses

Fuses (US/Canada)

Rated Voltage	Type	Rupture In (A)	Standards
≥ 500Vac	Fast	1.0A	UL248 (US) C22.2 No. 248 (CAN)

Fuses (Other Countries)

Rated Voltage	Type	Rupture In (A)	Standards
≥ 500Vac	Fast	1.0A	IEC 60269 - 2

4.2.5 Auxiliary Mains Fuses

Fuses (US/Canada)

Rated Voltage	Type	Rupture In (A)	Standards
≥ 250Vac	Fast	0.1A	UL248 (US) C22.2 No. 248 (CAN)

Fuses (Other Countries)

Rated Voltage	Type	Rupture In (A)	Standards
≥ 250Vac	Fast	0.1A	IEC 60269 - 2

4.3 Communications Options

Communications outputs are safety isolated from the measurement voltages at a minimum of 3.5kV.

Communications cables running within an electrical enclosure may come close to high voltages and therefore must be insulated to the following minimum specification:
Safety Compliant: e.g UL1015; Operating Temperature: 105°C (221°F); Insulation 600Vac

4.3.1 RS485 Output Terminals (Optional)

Voltage:	30Vdc (13-14, 13a-14a)
Cable:	30-14 AWG, Stripped 5.5 to 6.5mm (0.2” to 0.25”)
Torque:	0.5Nm (4.4in lb)

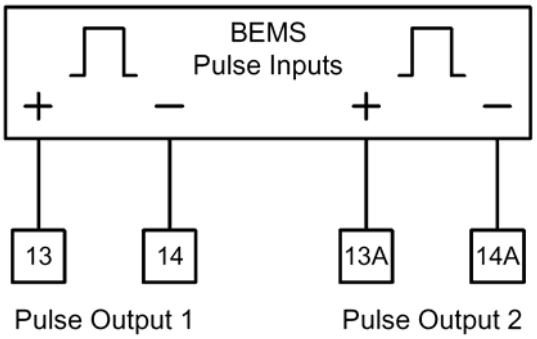
4.3.2 Ethernet Output (Optional)

Connection:	RJ45
Cable:	Cat5e FTP (Foil screened)

4.4 Pulse Output Connections

The pulse outputs take the form of isolated volt free normally open contact pairs. Pulse 1 is associated with active energy (kWh) and Pulse 2 with reactive energy (kvarh).
The contacts are isolated from all other circuits (3.5kV) and at 50V from pulse 1 to pulse 2.
Pulses can be used as input to remote counters, pulse loggers, building energy management system etc.

Light emitting diodes Л1 and Л2 remain ***ON*** during each associated output pulse.

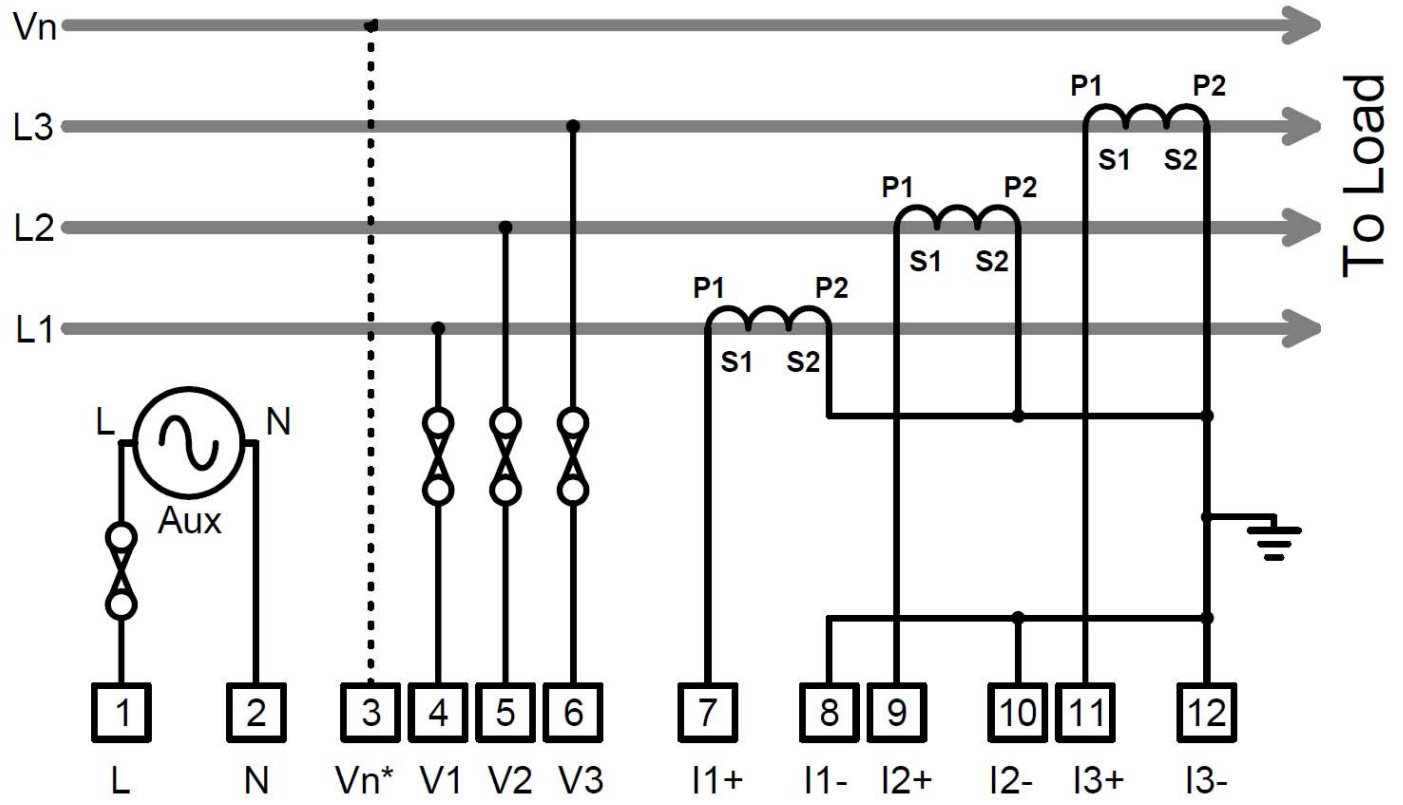


Pulse output cables running within an electrical enclosure may come close to high voltages and therefore must be insulated to the following minimum specification:
Safety Compliant: e.g UL1015; Operating Temperature: 105°C (221°F); Insulation 600Vac

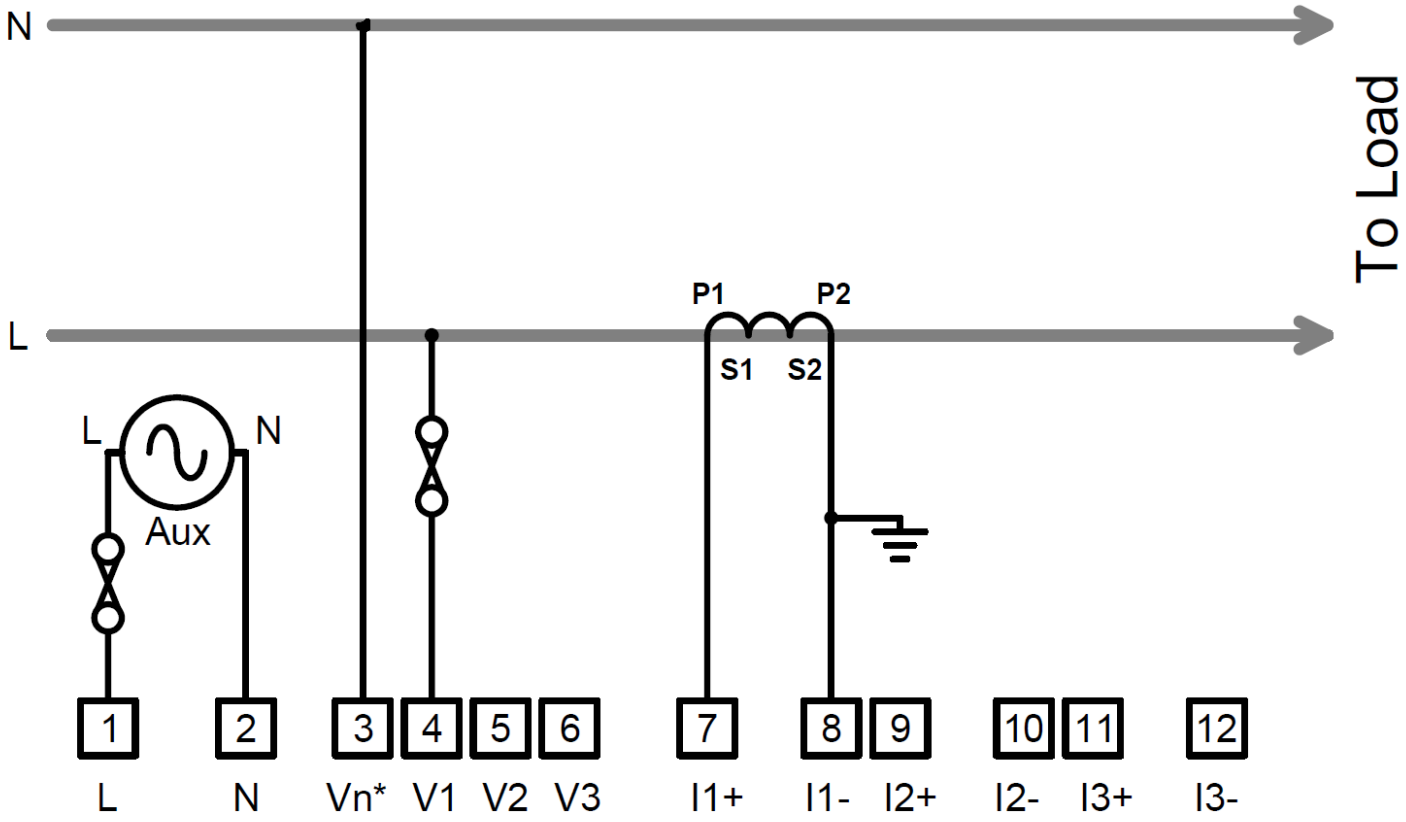
4.4.1 Pulse Output Terminals

Voltage:	70Vdc/33Vac (13-14, 13a-14a)
Cable:	30-14 AWG, Stripped 6.0 to 7.0mm
Torque:	0.5Nm (4.4in lb)

4.5 Typical Connections

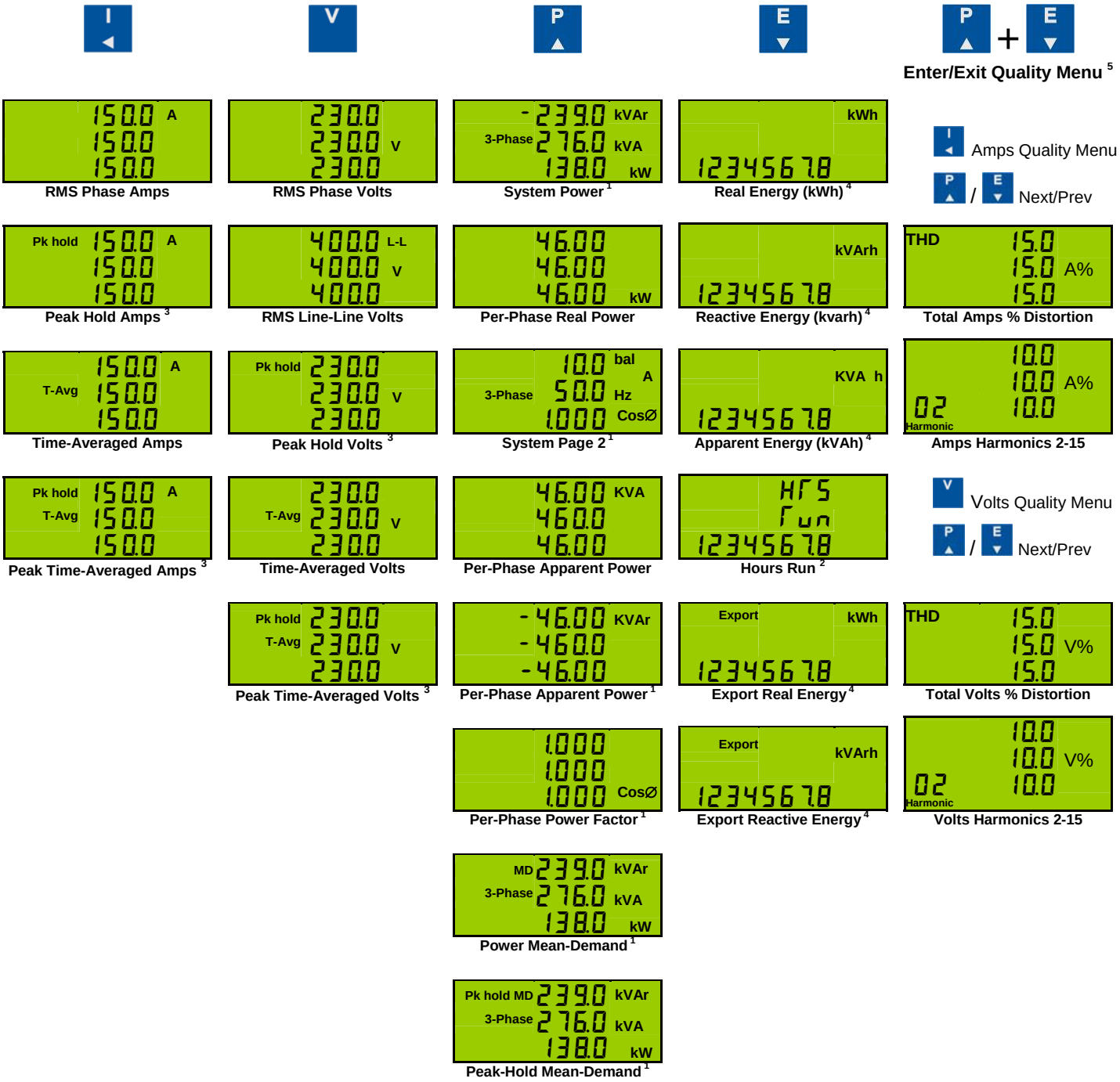


3-Phase 3 or 4-Wire (*Optional Neutral)



Single Phase

5 Display Menus



Note 1: A display of ⊣⊢ after a value indicates a capacitive load.

Note 2: The Hours Run register accumulates the total time during which the real power (kW) exceeds a preset level. This is always displayed with a resolution of 0.1hour.

The percentage level of kW at which the Hours Run register accumulates is user programmable from 1% to 100% of full scale current. Hours run reset cannot be disabled.

Note 3: Press I and V together and hold for 2 seconds to reset the displayed value. This feature may be disabled before mounting in a panel.

Note 4: 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.

Note 5: Power quality menus are optional on some meters.

6 Programming

I and E to enter programming.

P or E selects from the standard list of settings while L is displayed. (List Mode)

P or E increases or decreases the value while F is displayed. (Fine adjust)

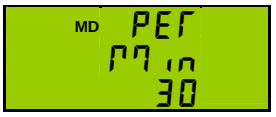
I and P together to toggle between L and F. I Accepts the set value.

Current Transformer Primary

Voltage Transformer Primary

Set the integration period in minutes used for the sliding time window MD calculation for kW and kvar.

P or E increments or decrements the value. I Accepts the set value.



Power MD Integration Time

Set the integration period in seconds used for the sliding time window calculation for voltage and current.

P or E increments or decrements the value. I Accepts the set value.

Current/Voltage Average Time

Set the instantaneous system kW level above which the Hours Run timer will accumulate. Below this level Hours Run will remain unchanged.

P or E increments or decrements the value. I Accepts the value.

Hours Run Trigger Point

Set the amount of energy (kWh Pls1 kvarh pls2) required to trigger each Pulse Output.

P or E selects the next/previous Pulse Rate. I Accepts the value.

Pulse Rate (kWh per Pulse)

Set the contact closure time for both pulse outputs.

P or E selects the next/previous Pulse Length from a standard list. I Accepts the value.

Pulse On Period (Seconds)

Tests both pulse outputs and associated circuits without the need of a test load.

P or E starts/stops a test pulse stream. The display shows Hld (Hold) or run. The counter shows the total number of pulses during the test.

I and V reset the test counter to zero. I exits pulse test mode.

Pulse Test Mode

7 Specification

INPUTS		
System	3 Phase 3 or 4 Wire Unbalanced Load or Single Phase	
Voltage Un	480/277V. 3 Phase 3 or 4 Wire	
	400/230V, 110/63V & 208/120V optional. Others to order.	
Current In	5Amp from external CTs. (1A optional) Isolated at 2.21kV	
Measurement Range	Voltage	20% to 120% Un
	Current	0.2% to 120%
Frequency Range	Fundamental	45 to 65Hz
	Harmonics	Up to 25th harmonic at 60Hz Individual to the 15th
Burden	Voltage	<0.1VA per phase
	Current	<0.1VA per phase
Overload	Voltage	x4 for 1 hour
	Current	x20 for 0.5 seconds max
DISPLAY		
Type	Custom, Supertwist, LCD	
Data Retention	10 years min. Stores kWh & Meter set-up	
Format	2 Rows x 4 Digits, 1 Row x 8 Digits + Legends	
Scaling	Direct reading. User programmable CT & PT CT Primary programmable from 5A to 25kA VT primary programmable from 10V to 440kV	
Legends	Wh, kWh, MWh etc. depending on user settings	
AUXILIARY SUPPLY		
Standard	230V 50/60 Hz ±15%	
Options	110V 50/60 Hz ±15%	
Load	5 Watt 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)	

PULSE OUTPUTS	
Function	1 Pulse per unit of energy
Scaling	Settable between 1 & 1000 counts of energy 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 ; 70Vdc/33Vac max ; 5W maximum load
Isolation	3.5kV 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
Isolation	3.5kV
ETHERNET (Option)	
Electrical	IEEE std 802.3. 2000 Edition
Data Rate	10 Mbits/s
Protocol	TCP, UDP, DHCP, FTP, TFTP, HTTP, SNTP, SNMP
Connection	10/100 Base T - RJ45
Isolation	3.5kV
GENERAL	
Temperature	Operating -10°C to +55°C (14°F to 131°F) Storage -25°C to +70°C (-13°F to 158°F)
Humidity	< 75% non-condensing
Environment	IP54 (when correctly mounted, as described, in a panel) Altitude <2000m (6561ft)
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) 3.78” x 3.78” x 3.29” (2.83” behind the panel)
Weight	~ 250 gms
SAFETY	
Conforms to	EN 61010-1 Overvoltage Category III & BS 8431

E. & O. E.