

# Cube400

## Installation Guide

### Revision 4



## 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:



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>  
Email: [sales@ndmeter.co.uk](mailto:sales@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<sup>®</sup> 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)<br>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)<br>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)

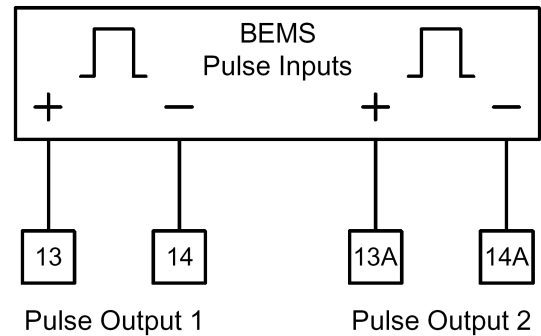
### 4.4 Pulse Output Connections

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  and  remain **ON** during each associated output pulse.

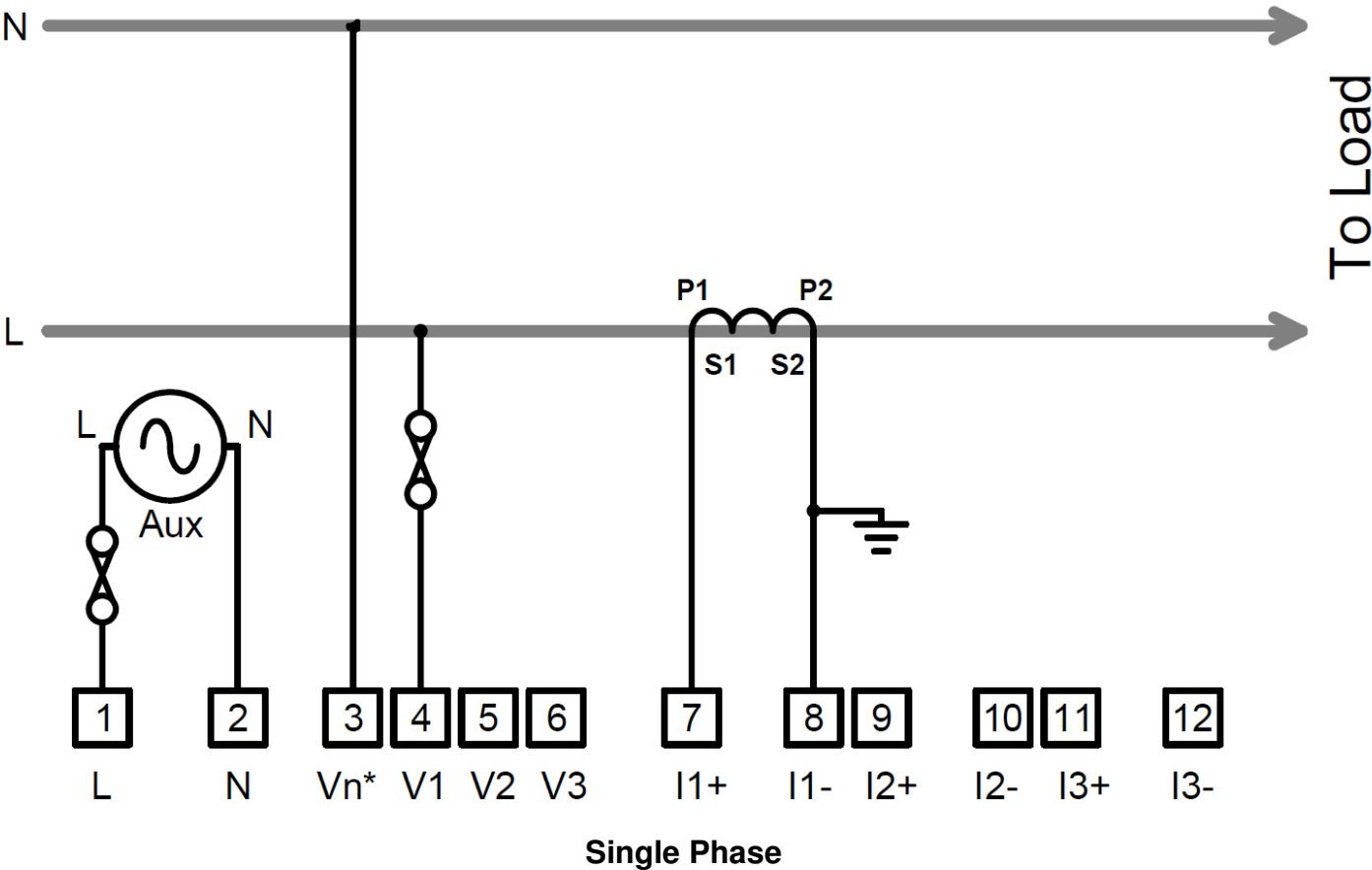
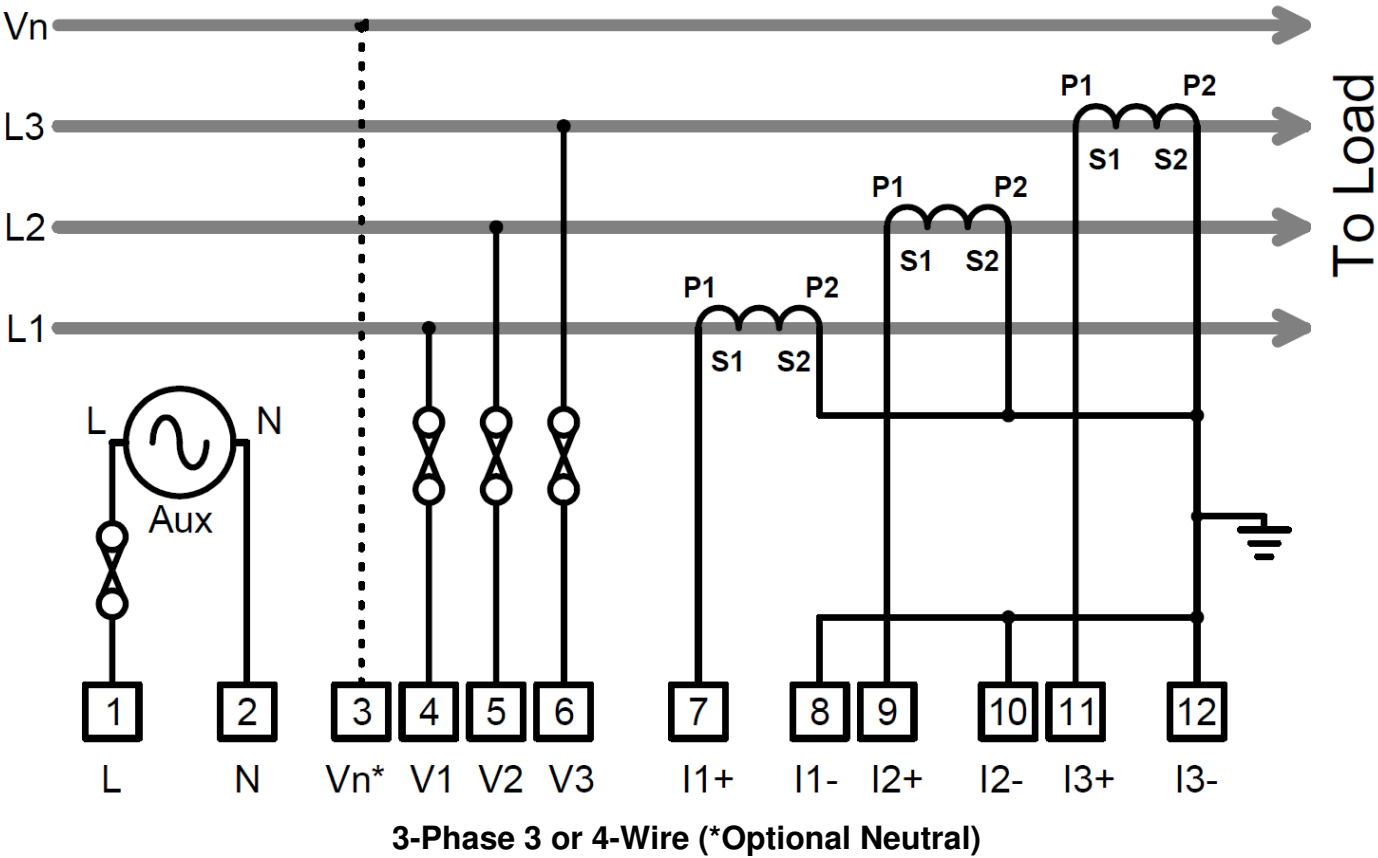


Pulse output cables running within an electrical enclosure may come close to high voltages and therefore must be insulated to the following minimum specification:  
Safety Compliant: e.g UL1015; Operating Temperature: 105°C (221°F); Insulation 600Vac


#### 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





## 5 Display Menus





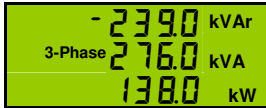
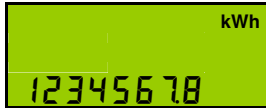






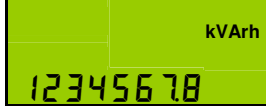



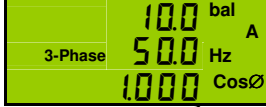
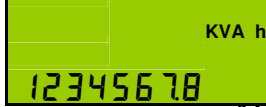
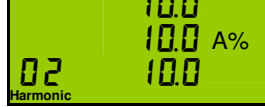
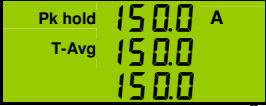


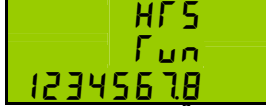



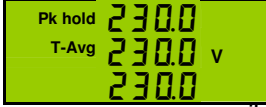

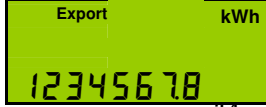



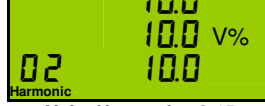
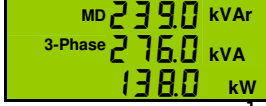
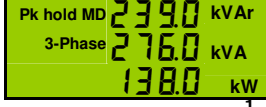











Enter/Exit Quality Menu <sup>5</sup>

|  |   |   |   |  |
|--|---|---|---|--|
| <br>RMS Phase Amps                       | <br>RMS Phase Volts                        | <br>System Power <sup>1</sup>              | <br>Real Energy (kWh) <sup>3 4</sup>        | <div style="text-align: center; margin-bottom: 10px;">  </div> Amps Quality Menu<br><div style="text-align: center; margin-top: 10px;">  /  </div> Next/Prev  |
| <br>Peak Hold Amps <sup>3</sup>          | <br>RMS Line-Line Volts                    | <br>Per-Phase Real Power                   | <br>Reactive Energy (kvarh) <sup>3 4</sup>  | <br>Total Amps % Distortion   |
| <br>Time-Averaged Amps                   | <br>Peak Hold Volts <sup>3</sup>           | <br>System Page <sup>1</sup>               | <br>Apparent Energy (kVAh) <sup>3 4</sup>   | <br>Amps Harmonics 2-15   |
| <br>Peak Time-Averaged Amps <sup>3</sup> | <br>Time-Averaged Volts                    | <br>Per-Phase Apparent Power               | <br>Hours Run <sup>2</sup>                  | <div style="text-align: center; margin-bottom: 10px;">  </div> Volts Quality Menu<br><div style="text-align: center; margin-top: 10px;">  /  </div> Next/Prev |
|  | <br>Peak Time-Averaged Volts <sup>3</sup> | <br>Per-Phase Reactive Power <sup>1</sup> | <br>Export Real Energy <sup>3 4</sup>      | <br>Total Volts % Distortion   |
|  |   | <br>Per-Phase Power Factor <sup>1</sup>  | <br>Export Reactive Energy <sup>3 4</sup> | <br>Volts Harmonics 2-15  |
|  |   | <br>Power Maximum-Demand <sup>1</sup>    |   |  |
|  |   | <br>Peak-Hold Mean-Demand <sup>1</sup>   |   |  |

**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 0.1 hour.



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  and  together and hold for 2 seconds to reset the displayed value. This feature may be disabled before mounting in a panel. Refer to Cube400 option links guide to disable.



**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

 and  to enter programming.

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




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

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

Current Transformer Primary




Voltage Transformer Primary <sup>6</sup>

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

 or  increments or decrements the value.  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.

 or  increments or decrements the value.  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.

 or  increments or decrements the value.  Accepts the value.

Hours Run Trigger Point

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

 or  selects the next/previous Pulse Rate.  Accepts the value.



Pulse Rate (kWh per Pulse)




Set the contact closure time for both pulse outputs.

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

Pulse On Period (Seconds)

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

 or  starts/stops a test pulse stream. The display shows **HLd** (Hold) or **Run**. The counter shows the total number of pulses during the test.

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

Pulse Test Mode

**Note 6:** If external VT is not used, **DO NOT ALTER** the voltage transformer primary setting for any other system voltage i.e. for 110V, 208V, 230V system. **LEAVE Un (Voltage Transformer Primary Setting) TO 480V ONLY.**

If external VT is used, alter the voltage transformer primary setting as stated in the following examples.

For 11000/110V VT, alter the setting to 48000 (multiplying factor: 11000 / 110 = 100 i.e. 480X100)

For 6600/110V VT, alter the setting to 28800 (multiplying factor: 6600 / 110 = 60 i.e. 480X60)

# Specification

|  |             |   |
|--|-------------|---|
| <b>INPUTS</b>  |             |   |
| System   |             | 3 Phase 3 or 4 Wire Unbalanced Load or Single Phase   |
| Voltage Un   |             | 480/277V. 3 Phase 3 or 4 Wire   |
| Current In   |             | 5Amp from external CTs. (1A optional) Isolated at 2.21kV  |
| Measurement  | Voltage     | 20% to 120% Un  |
| Range  | Current     | 0.2% to 120%  |
| Frequency Range  | Fundamental | 45 to 65Hz  |
|  | Harmonics   | Up to 25th harmonic at 60Hz<br>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   |
| <b>DISPLAY</b>   |             |   |
| 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<br>CT Primary programmable from 5A to 25kA<br>VT primary programmable from 10V to 440kV |
| Legends  |             | Wh, kWh, MWh etc. depending on user settings  |
| <b>AUXILIARY SUPPLY</b>  |             |   |
| Standard   |             | 230V 50/60 Hz $\pm 15\%$  |
| Options  |             | 110V 50/60 Hz $\pm 15\%$  |
| Load   |             | 5 Watt Max.   |
| Overload   |             | x1.2 continuous   |
| <b>METER ACCURACY      All errors <math>\pm 1</math> digit</b> |             |   |
| 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   |             | $\pm 0.2^\circ$ (0.05In – 1.2In and 0.2Un – 1.2Un)  |
| Neutral Current  |             | Class 0.5 IEC 60688 (0.05In – 1.2In)  |

|                                      |   |
|--------------------------------------|---|
| <b>PULSE OUTPUTS</b>                 |   |
| 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   |
| <b>MODBUS® Serial Comms (Option)</b> |   |
| 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   |
| <b>ETHERNET (Option)</b>             |   |
| 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   |
| <b>GENERAL</b>                       |   |
| Temperature                          | Operating -10 °C to +55 °C (14 °F to 131 °F)<br>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)<br>Altitude <2000m (6561ft)         |
| <b>MECHANICAL</b>                    |   |
| Terminals                            | Rising Cage. 4mm <sup>2</sup> (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)<br>3.78" x 3.78" x 3.29" (2.83" behind the panel) |
| Weight                               | ~ 250 gms   |
| <b>SAFETY</b>                        |   |
| Conforms to                          | EN 61010-1 Overvoltage Category III & BS 8431   |

E. & O. E.

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