

# ENERGY METER

**Model: EM 9005**



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## **INDEX**

- 1. General Features.....5**
- 2. Installation.....6**
  - 2.1) Selecting proper place.....6**
  - 2.2) Wiring.....7**
  - 2.3) Maintenance.....13**
  - 2.4) Calibration & Field service.....13**
- 3. Front & Rear Panel Features .....14**
- 4. Selecting PT, CT ratios .....15**
  - 4.1 Selecting CT primary setting .....15**
  - 4.2 Selecting PT primary setting .....16**
  - 4.3 Dipswitch Detail .....17**
- 5. Technical specification .....19**

## **ENERGY METER**

### **1. General Features**

ICD Digital Energy meter EM 9005 is designed with latest state of art Technology to work at only power factor under balanced or un-balanced loads. It offers high accuracy, reliability and also real value for money. They are all micro controller based instruments and can detect and store the energy consumption right from 0.5% to 120% of the Load current.

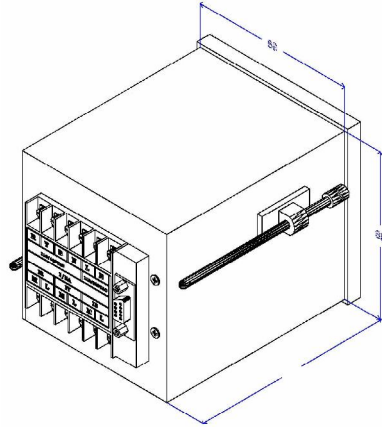
The Energy Meter registers the energy consumption(kWh) & active power(kW) in single row numeric LCD display with backlit facility. The LCD display is a 16 digit character with internal reset facility. 'SEL' key is provided on the front panel of the meter to toggle between kW & kWh pages. The front panel is provided with antiglare feature for improved readability. It has a calibration LED output for cross checking the readings. The meter computes all the parameters and updates them in every 2 seconds.

EM 9005 additionally gives 24V DC pulse output which can be connected to a DCS/PLC for remote energy data logging purpose. The CT primary setting for LT & HT meters & PT primary setting for HT meters are field configurable through dipswitches provided inside the instrument. The details about the selection of dipswitches are provided in the annexure.

## 2. Installation

Installation includes the following :

- 2.1) Selecting proper place for the Unit and its mounting.
- 2.2) PT, CT and Auxiliary supply wiring connections.
- 2.3) Maintenance.
- 2.4) Calibration and field service



### 2.1) Selecting proper place

First decide the place where the EM9005 is to be connected for measurement. If you do not have already an idea about that, then you can choose the load which can give you maximum energy saving or the load which is to be monitored more critically for measurement. Otherwise, you can discuss with your energy consultant for that. In any case, for best performance choose a place where all the PT, CT connections are available with minimum length.

While installing, provide sufficient space all around the meter for cooling air and protect the meter from dust, oil, corrosive vapours, moisture etc. The panel doors must be easily opened to provide easy access for EM9005 wiring for trouble shooting purposes. It is advisable to provide terminal blocks for PT connections and shorting blocks for CT connections for easy wiring and servicing. Since the meter is a panel mounting type, the cut out should be punched with a proper tool and should be free from burrs.

For maximum performance and to operate reliably the meter should be away from strong electromagnetic fields and the following temperature conditions should be met.

Storage temperature	:	- 20 to + 70°C
Operating temperature	:	0 to + 50°C

## **2.2) Wiring**

### ***2.2.1. Selection of PT & CT***

The energy measurement is done using the PT voltage and CT current inputs. Since the accuracy of measurement is basically determined by the accuracy class and phase shift of the PT's & CT's used. Hence the PT's and CT's should be of instrument class 1 or better for accurate measurement results.

Also the PT's and CT's must have correct VA rating to support the burden on the secondaries. If you want to connect the auxiliary supply also to one of the PT, ensure that the PT burden is properly rated. Increasing the wiring lengths of CT increases the resistance of the connecting wires which in turn will increase the burden of the CT.

The CT primary current must be selected optimistically. It should be selected such that your load current variations lies between 25% to 75% of its full scale value. If the CT is over rated for less than 10% of the load current it may affect the accuracy of the meter. If the CT is under rated, then you are in the risk of burning out both CT's and the energy meter.

### ***2.2.2 Voltage signal connections***

The EM9005 can accept voltages upto 415 VAC RMS phase to phase with 10% over load capacity in case of LT meters and 110 VAC RMS phase to phase with 10% over load capacity in case of HT meters. The HT meters are normally connected through PT's - the primary of the PT is field programmable upto 234 kV.

There are four voltage input terminals R, Y, B & N. The three phase supply has to be connected to those terminals. The detailed wiring diagram is pasted on the instrument. Before wiring, de-energise the PT supply to avoid risk of electric shocks by switching off the circuit breakers or by removing fuses. Do not short the PT secondary terminals. Voltages above the specified limits may cause the instrument to malfunction or may lead to permanent destruction of the meter.

The voltage input terminals has a burden of 0.25 VA per phase.

### **2.2.3 Current signal connections**

The EM9005 current inputs can accept 5A AC R.M.S for connecting the external CT's as standard. The EM9005 can also be provided with current inputs to accept 1 A AC R.M.S in case the available CT in the field has 1 A secondary. But it has to be specified while ordering. The CT secondary value is not field programmable. In both the cases the current inputs has over load capability of 150% (upto 120% accuracy is not lost)

There are three pairs of terminals marked Ir(M,L), Iy(M,L) & Ib(M,L) for the connection of external CT's. For proper measurements, the polarity of the CT's must be connected properly. Any unused CT terminals must be shorted (M & L) together.

Before wiring, de-energise the CT secondary by shorting it through a shorting block. The CT secondary should not be open circuited even for few seconds for any reasons.

The primary current of CT is field programmable upto 7500 A R.M.S in LT meters and upto 1500 A R.M.S in HT meters. Currents above specified limits may cause the instrument to malfunction or may lead to permanent destruction of the meter.

The EM9005 current input terminals has a burdern of 0.5 VA per input.

### **2.2.4 PT,CT wiring details**

Before wiring the PT and CT secondary terminals, following points are to be noted.

- a) The voltage to voltage inputs should not exceed 270VAC RMS (L-N) in case of LT meters. In HT meters the voltage inputs must be given through PT's and should not exceed 132V AC RMS (L-L).
- b) The current inputs is connected through CT's. The CT secondary current may be 1or 5A. They must be properly selected while ordering.
- c) If more than one equipment are to be connected in a loop, then the voltage inputs are to be connected in parallel and current inputs are to be connected in series.
- d) Check for correct polarities for voltage and current signals. e.g R phase CT is to be connected to terminal marked R

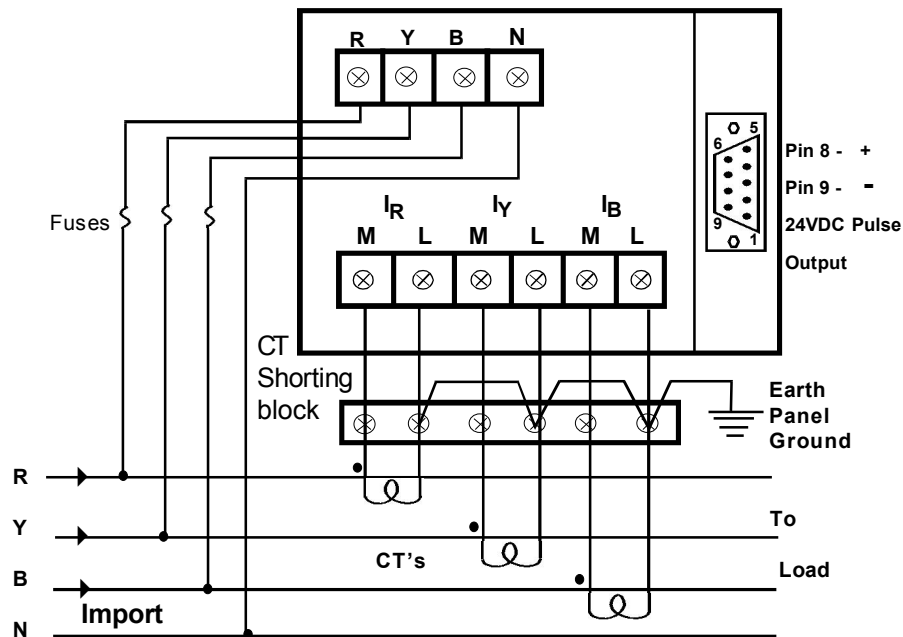
The EM9005 can perform energy measurements based on two watt meter method or three watt meter method depending on the system load. Three watt meter method of measurement is given as standard for LT meters and two watt meter method of measurement is given as standard for HT meters. In case , if two watt meter measurement is required for LT systems and three watt meter method is required for HT systems they can be obtained optionally by specifying it at the time of ordering. The measurement method selection is not field programmable.

### 2.2.5 Wiring Diagram

#### a) Three phase four wire LT systems (3 watt measurement)

**Voltage Input** : Direct 240V AC P-N (-20% to +10%)

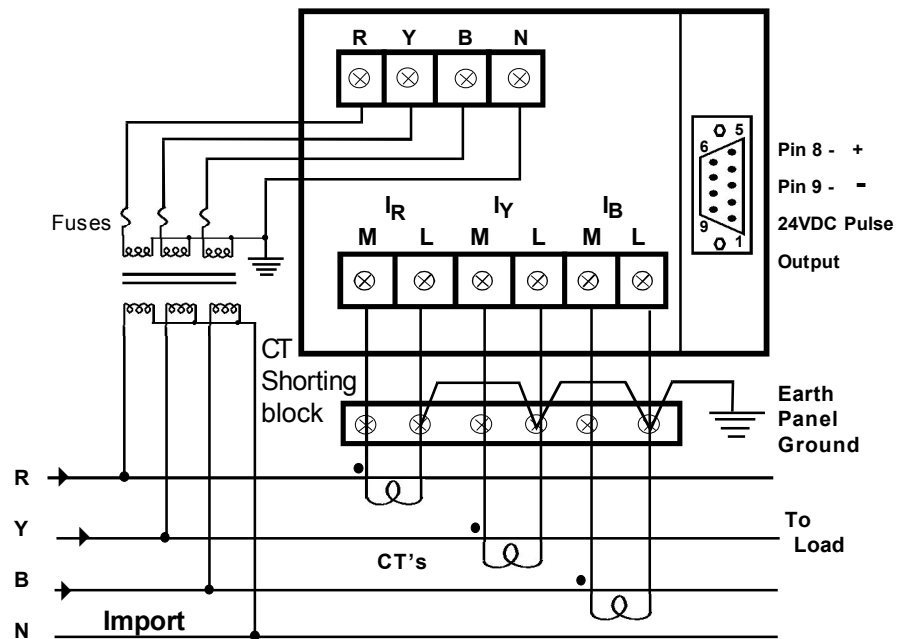
**Current Input** : 5/1A provide through 3 CT's



b) Three phase four wire HT systems (3 watt measurement)

Voltage Input : 110V AC (L - L)(Through PT)

Current Input : 5/1A provide through 3 CT's

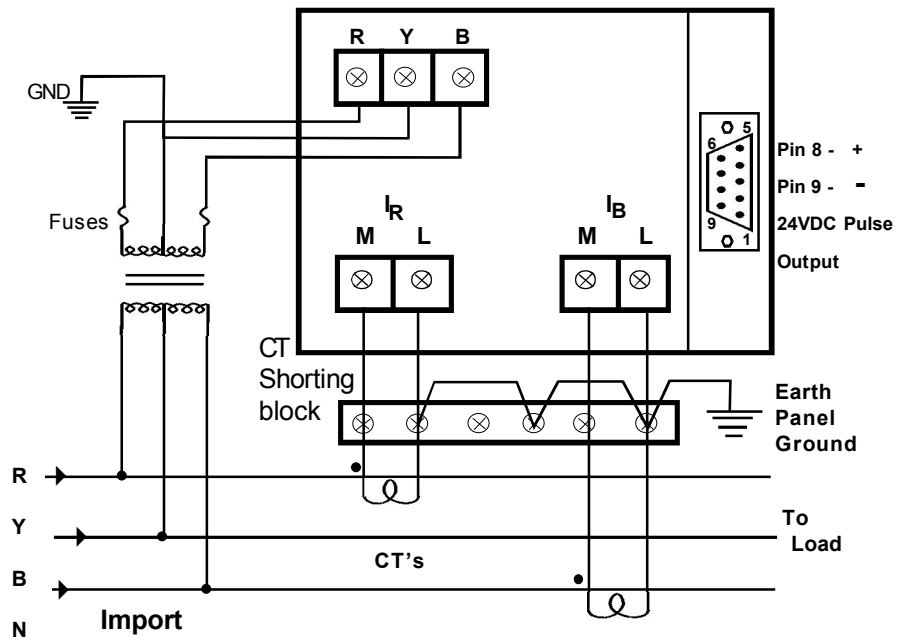




c) Three phase three wire HT systems (2 watt measurement)

Voltage Input : 110V AC (L - L)(Through PT)

Current Input : 5/1A provide through 2 CT's



### **2.2.6 Cross checking the wiring**

The three phase voltage wiring and the current wiring are to be properly done for the correct measurement. Any wrong connections done either during installation or during rewiring can produce wrong measurement of energy in the instrument.

The EM9005 is provided with a reverse negative sign indication for checking the wiring. The negative sign appears, when the phase angle between the voltage vector and its respective current vector is more than  $90^\circ$  Lag or Lead. While checking the reverse status make sure that the load current is more than at least 5% of the full load current and load is in import mode. Because the capacitor banks, if remain in the load may produce highly leading phase angles.

If the negative sign appears, it means that the reverse energy is consumed by the load. It may be due to wrong connections or the load may be in export mode. Under both conditions, the mechanical counter does not increment and there will not be any energy accumulation.

### **2.2.7 Auxiliary power supply connections**

The auxiliary power supply to supply power for the electronic circuitry inside the EM9005 is derived from the PT voltages. If the PT burden is not sufficient in the case of HT meters, then auxiliary power supply can be given separately. The auxiliary power supply can be either 110/240V AC and has to be specified at the time of ordering. The EM9005 has a burden of 4 VA on the auxiliary power supply terminals.

**2.3) Maintenance**

No maintenance is normally required for the EM9005 except cleaning the dust accumulated on the front panel and back terminals. For cleaning the front panel, use a soft cloth immersed in soap water and wipe gently the front panel without exerting excess pressure. The terminals are to be cleaned only after switching off the PT & CT connections to avoid the risk of electric shocks. Do not use water or wet clothes to clean the terminals. Use brushes to clean the dust present in the terminal blocks. The proper tightness of the terminal blocks screws can also be checked.

**2.4) Calibration & Field service****2.4.1. Calibration**

The rated accuracy drift of the EM9005 is % per year. The user can decide the calibration interval depending upon his accuracy requirement. The EM9005 cannot be calibrated by the user in the site. For periodic calibration contact ICD or its representatives.

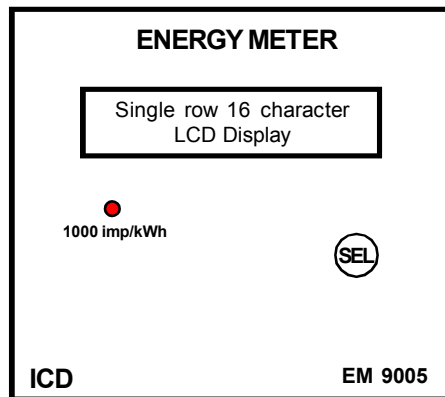
**2.4.2 Field service**

The EM9005 is very reliable and is provided with necessary recovery systems to handle severe disturbances. In case, if the EM9005 fails, contact ICD or its representatives. Do not attempt to service by yourself, because the EM9005 does not have any user servicable parts.

**Note:** *During normal operations, high voltages are present through out the PT terminals, CT terminals and auxiliary supply terminals. Touching those terminals in energised condition may cause severe injury or even death. So installation and removal of EM9005 must be carried out by technical person.*

### 3. Front & Rear Panel Features

#### 3.1 Front Panel Features



The LCD Display is a single row 16 character Alpha numeric display with backlit. The LCD Display is used to display kW & kWh. 'SEL' key is provided to toggle between the display pages.

Calibration pulse output is provided through 3mm RED LED in front panel. Meter constant is 1000 impulse/kWh.

**Note :** 3200 Impulse also provided as ordering Option

#### 3.2 Rear Panel Features

Rear Panel consists of terminals for PT , CT input & Auxiliary Supply. Auxiliary supply is provided as ordering option. 24 V DC Pulse output (1 pulse for 0.1 kWh) is available through 9 pin female D'Connector.

#### 4. Selecting PT, CT ratios

- 4.1 Selecting CT primary setting (LT & HT Meters)
- 4.2 Selecting PT Primary setting (HT meters)
- 4.3 Dipswitch Detail

##### **4.1 Selecting CT primary setting**

The primary current of CT is field programmable by a 8 bit dip switch provided inside the instrument. This feature allows the user to use the same EM9005 at various panels.

The Dip switch has 8 bits and two positions ON & OFF. The OFF position is indicated as 0 and ON position is indicated as 1. The multiplier and the number can be properly selected to match the primary current of CT.

For e.g to select CT ratio of 1000/5 follow the procedure given below.

##### **In LT Meter :**

The bits 1,2,3,4 & 5 represents a number and bits 6,7,8 represents a multiplier.

- a) The primary current of CT is 1000.
- b) Select the multiplier  $1000/10 = 100$ . The maximum of number that can be selected is 31. Select the multiplier so that the quotient is equal to or below 31 without any remainder. Selecting the multiplier 100 gives  $1000/100=10$ .
- c) Select 10 in the numbers side by switching on 4th & 2nd bit and switching off 1st, 3rd & 5th bit.
- d) Select 100 in the multiplier side by switching on 8th & 6th bit and switching Off 7th bit.



Thus by properly selecting the multiplier and the number any CT ratio can be set. The maximum primary current that can be set is  $250 \times 31 = 7750A$

**In HT Meter :**

The bits 1,2,3 & 4 represents a number and bits 5,6 represents a multiplier.(7 & 8th bit in dipswitch is dummy)

- The primary current of CT is 1000.
- Select the multiplier  $1000/10 = 100$ . The maximum of number that can be selected is 15. Select the multiplier so that the quotient is equal to or below 15 without any remainder. Selecting the multiplier 100 gives  $1000/100=10$ .
- Select 10 in the numbers side by switching on 4th & 2nd bit and switching off 1st, 3rd & 5th bit.
- Select 100 in the multiplier side by switching on 5th & 6th bit .



Thus by properly selecting the multiplier and the number any CT ratio can be set. The maximum primary current that can be set is  $100 \times 15 = 1500A$

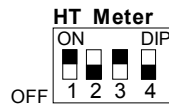
**4.2 Selecting PT primary setting (only in HT meter)**

The primary current of PT is field programmable by a 4 bit dip switch provided inside the instrument. This feature allows the user to use the same EM9005 at various panels and also applicable for HT Meters.

The Dip switch has 4 bits and two positions ON & OFF. The OFF position is indicated as 0 and ON position is indicated as 1.

For e.g to select PT ratio of 11kV/110V AC follow the procedure given below.

- The primary Voltage of PT is 11000.
- Select 11000 by switching on 1st & 3rd bit and switching off 2nd & 4th bit.

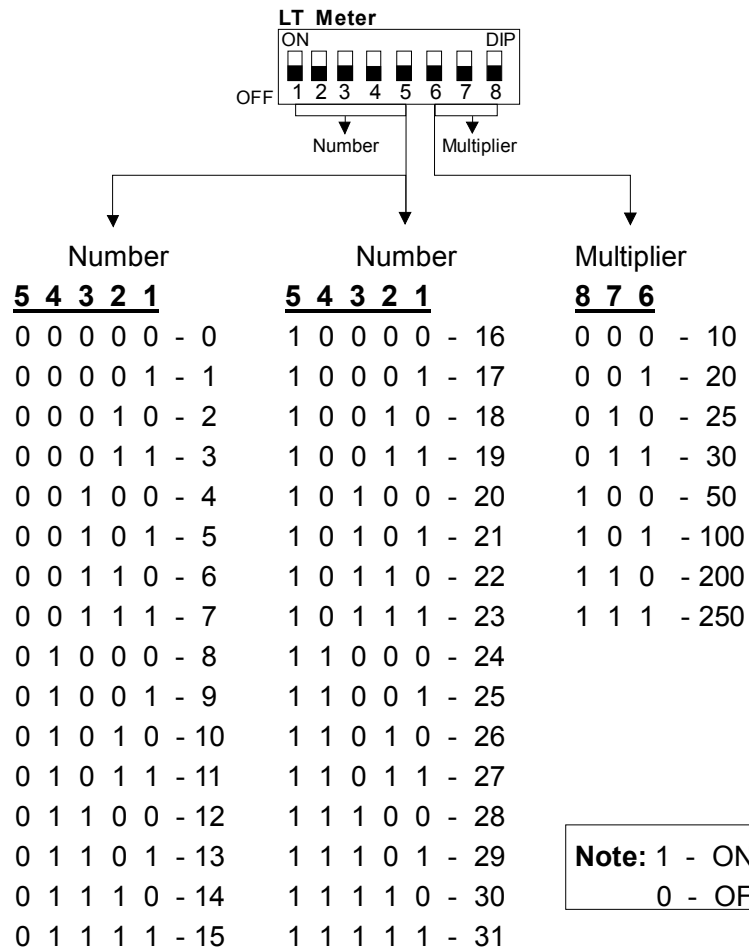


Dipswitch selected for 11kV

The maximum primary voltage that can be set is 220 kV in HT meters.

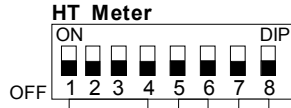
### 4.3) Dipswitch Details (Dip Swithes are located inside the meter)

#### 4.3.1 LT Meter - Primary current setting (8 bit Dipswitch)



(**Note :** In CT dipswitch if number is selected as Zero, primary current setting is taken as 5 A -in both LT & HT meters)

**4.4.2 HT Meter - Primary current setting (8 bit Dipswitch)**



Number Multiplier Dummy (not used)

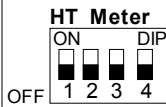
**4 3 2 1**

**6 5**

0 0 0 0 - 0	0 0 - 20
0 0 0 1 - 1	0 1 - 25
0 0 1 0 - 2	1 0 - 50
0 0 1 1 - 3	1 1 - 100
0 1 0 0 - 4	
0 1 0 1 - 5	
0 1 1 0 - 6	
0 1 1 1 - 7	
1 0 0 0 - 8	
1 0 0 1 - 9	
1 0 1 0 - 10	
1 0 1 1 - 11	
1 1 0 0 - 12	
1 1 0 1 - 13	
1 1 1 0 - 14	
1 1 1 1 - 15	

**Note:** 1 - ON  
0 - OFF

**4.4.3 HT Meter - Primary Voltage setting (4 bit Dipswitch)**



<b>4 3 2 1</b>	<b>4 3 2 1</b>
0 0 0 0 - 415	1 0 0 0 - 22000
0 0 0 1 - 1100	1 0 0 1 - 24000
0 0 1 0 - 2200	1 0 1 0 - 33000
0 0 1 1 - 3300	1 0 1 1 - 66000
0 1 0 0 - 6600	1 1 0 0 - 110000
0 1 0 1 - 11000	1 1 0 1 - 132000
0 1 1 0 - 13200	1 1 1 0 - 145200
0 1 1 1 - 16500	1 1 1 1 - 220000



## 5. Technical specification

Type	: ICD make <b>ENERGY METER (EM 9005)</b> LT / HT Application
Voltage Input (Line to Line)	: <b>LT</b> : 415 AC RMS (-20% to +10%) <b>HT</b> : 110V AC RMS (-20% to +10%)
Current Input	: 5AAC R.M.S. (Standard) 1AAC R.M.S. available as ordering option.
Frequency	: 45.00 to 55.00 Hz
Measurement Method	: 3 Watt Meter (Standard) 2 Watt Meter available as ordering option.
Over Load Capacity	: 10A Max continuous, 50A max for 3 seconds
Working Load Range	: 0.5% to 120% of load current
Working PF Range	: 0.3 PF Lag to 0.3 PF Lead
Accuracy	: 0.5 Class as per IEC 687
Display	: 1 row 16 character LCD Display with Backlit
Character Size	: 6.30(H) x 3.15(W) mm
Parameters shown	: kW & kWh
Resolution kW	: 0.1 kW (less than 1000 kW) 1 kW (1000kW and above)
Phase Reverse Indication:	Provided by showing minus sign in Instant kW
Energy Registering during Reverse	: Not done
Energy Storage	: In non-volatile EERAMs
Primary Current setting	: Through 8 bit dipswitch provided inside the Unit.
Primary Voltage setting	: Through 4 bit dipswitch provided inside the Unit. (for HT meters)
Display page selection	: By 'SEL' key provided in front panel.
Calibration pulse O/P	: Provided thru' IR LED in front panel & 24 V DC Pulse output in the back panel of the meter
Meter Constant	: 1000 imp/kWh (upto 7000kW Instant Load)
Burden on Voltage I/P	: 0.25VA per phase
Burden on Current I/P	: 0.5 V A per phase
Burden on Auxiliary I/P	: 4 V A

Operating Temperature	: 55°C Max.
Auxiliary Supply	: 240V AC RMS derived from Voltage input terminals. External 110V /240V AC RMS available as ordering option.
Box Dimension	: 96(W) x 96(H) x 120(D) mm
Cutout	: 92 x 92mm
Mounting	: Panel
Enclosure	: ABS Plastic case
Weight	: 400 gms (Approximately)