User Manual

PREPAID METER

THREE PHASE | SINGLE PHASE

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Possibilities...Infinite

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1. INTRODUCTION

A Prepaid Energy Meter enables power utilities and the maintenance team to collect electricity bills from the consumers prior to its consumption. The prepaid meter is not only limited to Automated Meter Reading [AMR] but is also attributed with prepaid recharging ability and information exchange with the utilities pertaining to customer's consumption details.

The idea of prepaid metering will be very important for the new research fields of Micro-grid and Smart Grid and is an inevitable step in making any grid smarter than it is now. Prepaid is a plan that deducts usage charges and any fixed charges from account balance each day. Consumer is expected to take responsibility.

This Unique product termed as Contactless prepaid energy meter developed by Elmeasure, is probably the first of its kind in the Indian meter manufacturing history. The design is completely microcontroller based thus provides effective solution to the electrical service providers. The action required by the service provider is just to install the meter and further activities involve only the consumer, which then is a very simple procedure to be followed. It is sufficient for the service provider to have only one man power or no man power to recharge the meter as per the consumer's requirement. This is not only limited to power and energy, Elmeasure devices also can integrate gas and water meter with the different inlets of the house and deduct the balance based on consumption. The meters can be networked with RS485, GSM/GPRS. The unique data communication enables the secured recharging of the meter. Elmeasure has developed ELNet PPS software which enables the customer to recharge the meters 24x7 using the payment gateway without even visiting the service provider.

The microcontroller acquires signals from the metering element(s), processes them and calculates values of measured energy or gas and water. The results are stored in registers for particular tariffs. The microcontroller also generates pulses for the LED and, enables two-way communication via the RS485 and drives the LCD and the control outputs.

1.1. IMPORTANT INSTRUCTIONS

This Unit is meant to be installed on electrical panels for measurement / analysis / control of electricity. It should be installed only by qualified, competent personnel who have the appropriate training and experience with high voltage and current devices.

DANGER 	Failure to observe the following may result in serious injury or death

! During normal operation of the Unit, hazardous voltages are present on its terminal strips. Follow standard safety precautions while performing any installation or servicing work (i.e. removing PT fuses, shorting CT secondary's, etc.)

! Voltage inputs including auxiliary supply must be protected by fuses in each circuit.

! Under no circumstances should the current input to the Unit be disconnected while current is flowing in the primary circuit of the Current Transformer on the line.

CAUTION 	For reliable operations establish input connections for voltage, Current and Aux. supply through spade lugs crimped to wire ends

! The front panel of the Unit lists the voltage and current limits that may be applied to various terminals. Application of inputs beyond these limits may result in permanent damage to the Unit and will render the warranty void.

1.2. ABOUT THIS GUIDE

This document describes the Features of prepaid meter, Installation, Operation, Technical Specifications and Communication options. It is intended for use by metering administrators, installers, and meter technicians.

1.3. PREPAID METER UNIQUE FEATURES

- User friendly Prepaid Energy Metering Solutions
- Money based recharging. No separate recharging for EB and DG
- Integration of Gas and Water with the electrical parameters thereby, extending the flexibility for the user to budget expenses
- Threshold point of kVA separately for EB and DG programmable to the individual customers with the ON/OFF profiling to save the equipment in the house
- Direct current measurement 10/ 60A (default) for Single or three phase measurements
- Charging the meter with credit revenue through secured communication
- Elmeasure encryption is added on top of this to provide the better security
- Emergency credit for the selected customer
- Remote ON / OFF load by the service provider
- Pulse data collection from up to four external devices, such as gas or water meters, with tamper monitoring included (optional feature)
- LED pulse outputs for accuracy verification of kWh
- Meter can be manufactured with kWh and kVAh
- Signal relay for control of external contactor or other devices, with activation linked to the currently active tariff period or controlled by remote command (optional feature)
- Visual blinking on display indication to customer for low balance, over voltage, over KVA etc
- Remote Display Unit allowing customer to recharge and monitor consumption
- Elmeasure prepaid meter has great optional feature i.e. individual phases on for DG (R, Y, B or RYB or No DG). This feature can avoid ACCL to individual houses.
- Optional Battery-backed Real Time Clock (RTC) to maintain time accuracy and tamper detection during power outages.

1.3.1. BENEFITS OF PREPAID METER

- **Improved operational efficiencies:** The prepaid meters are likely to cut the cost of meter reading as no meter readers are required. In addition, they eliminate administrative hassles associated with disconnection and reconnection

- **Reduced financial risks:** Since the payment is up-front, it reduces the financial risk by improving the cash flows and necessitates an improved revenue management system
- **Better customer service:** The system eliminates billing delay, removes cost involved in disconnection/reconnection, enables controlled use of energy, and helps customers to save money through better energy management
- The whole process of billing can be centralized
- Cost of manpower for billing / collection is reduced or Nil
- This avoids the hassles of human intervention as there is no need to enter the data into the meter. This makes the system more users friendly
- Displays balance Energy in the meter, thus enabling the consumer to plan when to recharge
- The smart recharge software (ELNet PPS) running in the service room has the option of deducting the common lighting charges/maintenance charges either fixed for a month or based on the amount of area occupied

1.3.2. APPLICATIONS OF PREPAID METER

- Large scale development by utilities for Residential and Commercial connections
- Sub-metering in Apartments, Shopping malls and Building complexes
- Convenient mode of payment in housing colonies
- As a second meter between utility meter and distribution board for housing tenants
- Selective deployment by utilities in regions with poor credit history
- Electricity supply for vendors, contractors and temporary connections

2. INSTALLATION

2.1. SAFETY WARNINGS

Before you install and operate your meters, it is important to be familiar with all regulatory agency, manufacturer, and utility industry safety precautions. Observe these safety precautions during all steps of meter installation, operation, and service. Failure to comply with these precautions, or with specific warnings or instructions elsewhere in this guide, violates safety standards of design, manufacture, and the intended use of the meter. Elmeasure assumes no liability for failure to comply with these requirements.

The information presented in this guide is intended to be an aid to qualified metering personnel. It does not replace the extensive training necessary to handle metering equipment in a safe manner.

Safety Warning: Any work on or near energized meters or other metering equipment presents the danger of electrical shock. Only qualified electricians and metering specialists should be authorized to work with the meters, in accordance with local utility safety practices, utility requirements, and other safety precautions as dictated by local code, regulations, or statutes.

INCOMING INSPECTION

Before the meter is installed, visual inspection, for any damage in the process of transportation, has to be carried out.

Safety Warning: Return damaged meters and components to Elmeasure do not attempt to repair the damage. The meter has no user-serviceable parts. Any attempt to remove or repair internal parts voids the meter warranty.

REPACKING

If the meter has to be returned to the supplier, repack the unit in the packing in which it was supplied.

OPTIMUM FIELD CONDITIONS

For the reliability and better life of the product the unit has to be operated at moderate temperatures and humidity. The meter is designed to work from -5 to 60 degree C and humidity of 95% RH non condensing.

STORAGE

In case if the meter is not installed after receiving, it has to be stored in a dry place in the original packing material.

MOUNTING

Figure shows the location of the meter mounting holes. The Mount the Prepaid Energy Meter in a dry location free from corrosive vapours. To mount the Unit: In the real panel side we have wall mountable clamp, by using that mount the prepaid meter on the wall.

Fig. 1: Drawing for Single phase mounting details

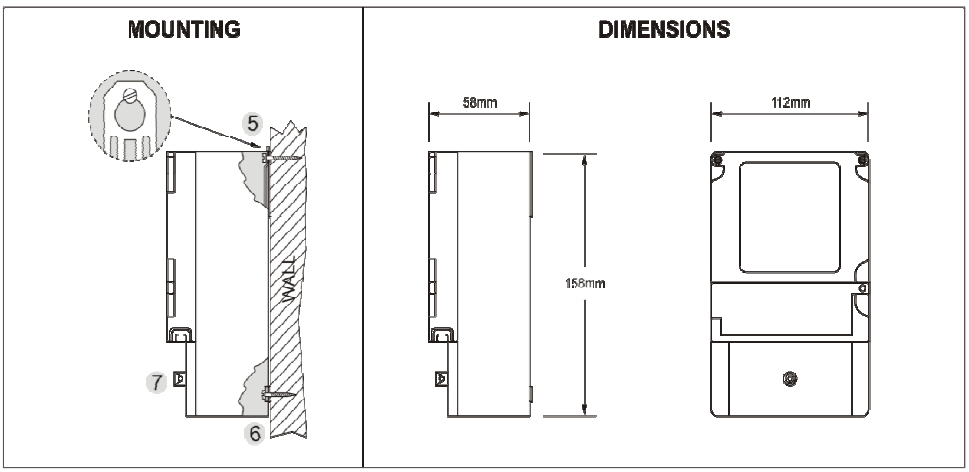
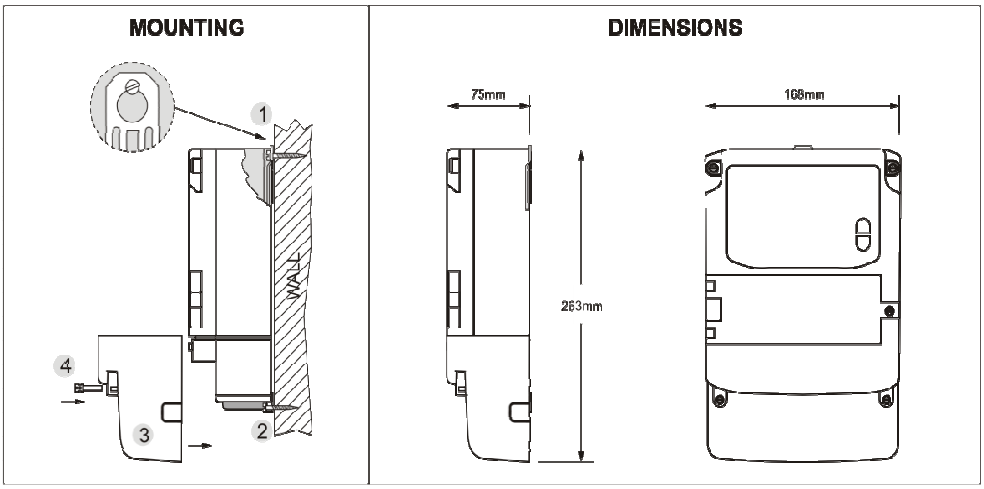


Fig. 2: Drawing for Three phase Mounting details



Mounting: The front bezel of the basic model is molded plastic. Bezel dimensions are 160 x 112 mm (Depth 58mm behind bezel) for single phase prepaid meter and 173 × 262 mm (Depth 82mm behind the bezel) for three phase prepaid meter.

EXTRA PRECAUTIONS

Make sure of supply voltage, supply current and configuration. Wrong connection can severely damage the instrument, which is not covered under our warranty.

We recommended installing necessary protective device along with the meter like circuit breaker / Fuse/ MCB/ Switch/ Isolator to take care of unexpected faults.

CONNECTION

The meter uses a polycarbonate casing and so is a good insulator. Hence it **DOES NOT HAVE ANY EARTH TERMINAL.**

Terminal cover is to be used to protect the meter terminals from being tampered with. As soon as the connections are made the terminal block has to be covered and sealed by terminal cover. It can be fixed using two sealable screws.

VENTILATION

No specific ventilation is recommended. Meter is capable of working satisfactory at Ambient between -5 to 60 degree C.

2.2. WIRING THE PREPAID METER

The inputs to be connected to the Prepaid Energy Meter are clearly indicated on the Front Panel.

Connect the Voltage inputs: For LT Models (415 V AC L-Nominal), connect the voltage inputs directly to the terminals. For HT Models, the inputs should be from the secondary of the Potential Transformer. In a 3-wire system, the Neutral terminal is not connected. In a 4-wire system, the neutral may or may not be connected to the terminal marked 'N'.

Connect the Current inputs: It is important to maintain the direction of the current flow from S1 to S2. If this reversed in one or more phases, the Power computation will be negative in the corresponding element(s). Though the computation is internally corrected to an equivalent positive value, it is not advisable to leave a reversal of current flow uncorrected.

It is important to adhere to phase relationships. Current 'IR' must correspond to the phase that has the Voltage connected to the 'VR' terminal. The same holds good for current inputs 'IY' and 'IB'. If the current and voltage inputs are swapped, the Power and Energy computations may be erroneous.

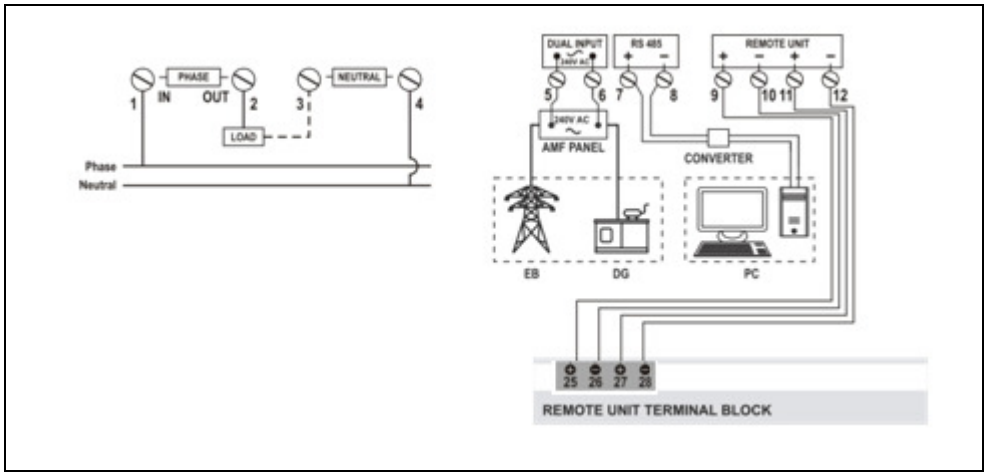


Fig. 1: Connection diagram for Single Phase Prepaid Energy Meter

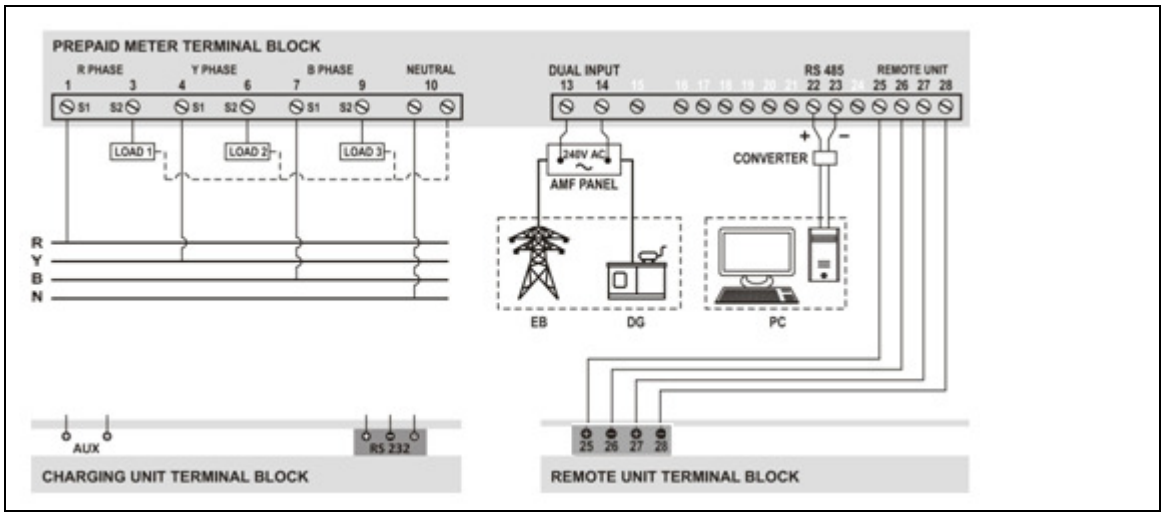


Fig.2: Connection diagram for Three Phase Prepaid Energy Meter (Whole current measurement)

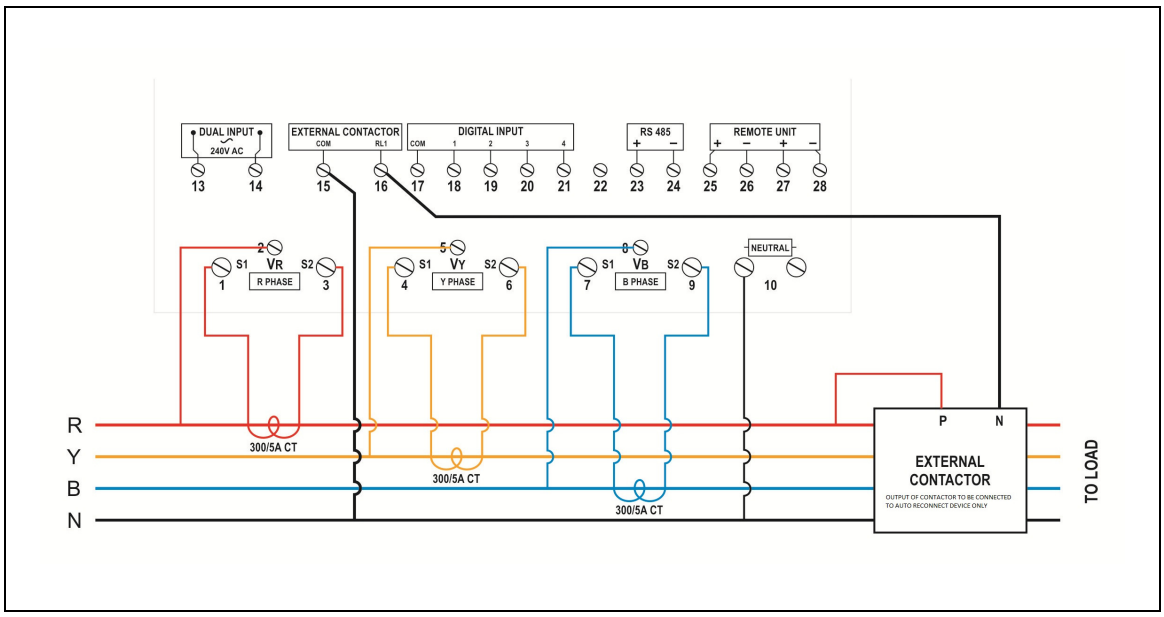


Fig. 3: Connection diagram for CT Operated Three Phase Prepaid Energy Meter

Wire the Dual Input

The Unit is capable of monitoring electricity consumed from two separate sources. One of these could be the supply from the electricity authorities while the other could be from the in-house generator. For the meter to recognize that the supply is from the alternate source, the meter requires a voltage input between 240 V AC that should go live when the supply is from the alternate source as shown in Fig 2.

Wire the Digital Inputs (Max.4)

Integration of Gas and Water with the electrical parameters thereby, extending the flexibility for the user to budget expenses. The four digital inputs, any gas and water meter can be configured. It is important to program the price / Pulse in the corresponding ElNet PPS.

Wire the Communication (RS485)

The Prepaid Energy Meter is equipped with an RS-485 Serial Communication Port or GSM/GPRS and operates on the MODBUS-RTU protocol.

Wire the Remote Unit

The Prepaid Energy Meter is equipped with Remote Unit; it has four terminals, two terminals for 5V supply to Remote Unit and two terminals for RS485 communication to Remote Unit.

2.3. INSTALLING THE METER

The device should be installed in a place where it will not be at risk of damage or near any unauthorized current connection. The sealing of the distributor housing is recommended. The producer is not responsible for any damage caused by improper assembly, service and product maintenance.

2.3.1. INSTALLING A METER IN A NEW LOCATION

To install the Elmeasure's prepaid meter in a new location:

- Remove the terminal cover from the meter
- Install the meter in an upright position, using mounting hardware that is appropriate for the type of surface material
- Connect the line and load wires to the meter terminals, being careful to use the correct phase, neutral, and line/load configuration
- Turn the supply line power to the meter on
- Test each phase line terminal of the meter to make sure power is on to each phase, and that the neutrals are connected to the proper terminals
- Test the load terminals of the meter to make sure power is available to each phase of the load.
- Check the display for proper operation of the meter
- Replace the terminal cover. Apply a seal to the sealing screw if necessary or desired. The installation is complete

2.3.2. REPLACING AN EXISTING METER

To install the Elmeasure's prepaid meter in a existing meter location:

Precaution: Make sure the existing meter and Elmeasure meter mounting mechanism is same.

- Turn off the line power to the existing meter

  Caution: *Test existing meter terminals to be sure the voltage is off.*
- Remove the line and load wires from the existing meter terminals. Make sure you label the wires, or have a method to identify the line and load wires of each phase, R, Y, B, and neutral, for proper installation in the new meter
- Remove the old meter
- Install the Elmeasure's prepaid meter in the same location as the previous meter, using mounting hardware that is appropriate for the type of surface material
- Inspect the line and load wires to make sure they are not damaged or frayed. (Replace if needed.)
- Connect the line and load wires to the meter terminals, being careful to use the correct phase, neutral, and line/load configuration
- Turn the supply line power to the meter on
- Test each phase line terminal of the meter to make sure power is on to each phase, and that the neutrals are connected to the proper terminals
- Test the load terminals of the meter to make sure power is available to each phase of the load.
- Check the display for proper operation of the meter
- Replace the terminal cover. Apply a seal to the sealing screw if necessary or desired. The installation is complete

2.3.3. INSTALLING THE SIM CARD INTO THE DEVICE (GSM/GPRS METERS)

GSM/GPRS based prepaid meters SIM holder having two symbols on the downside. Down symbol for opening the SIM holder and up symbol for locking the SIM holder.

- Open the SIM holder by click down symbol of the SIM holder
- Insert the SIM into the holder
- Lock the SIM holder by click up symbol of the SIM holder

2.3.4. INSTALLING THE REMOTE UNIT

- Connect the Remote unit power supply and RS485 terminals to Prepaid meter Remote Unit terminals as shown in the connection diagrams
- Connect the EB/DG input to Prepaid meter and output of prepaid meter connected to load

Fig.1: Connection diagram for single phase prepaid energy meter with remote and charging unit

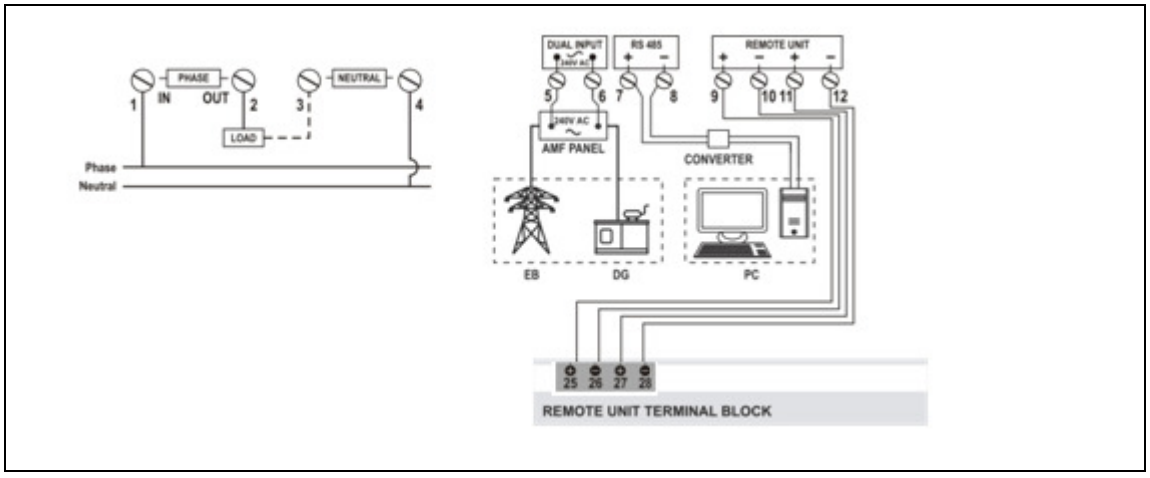
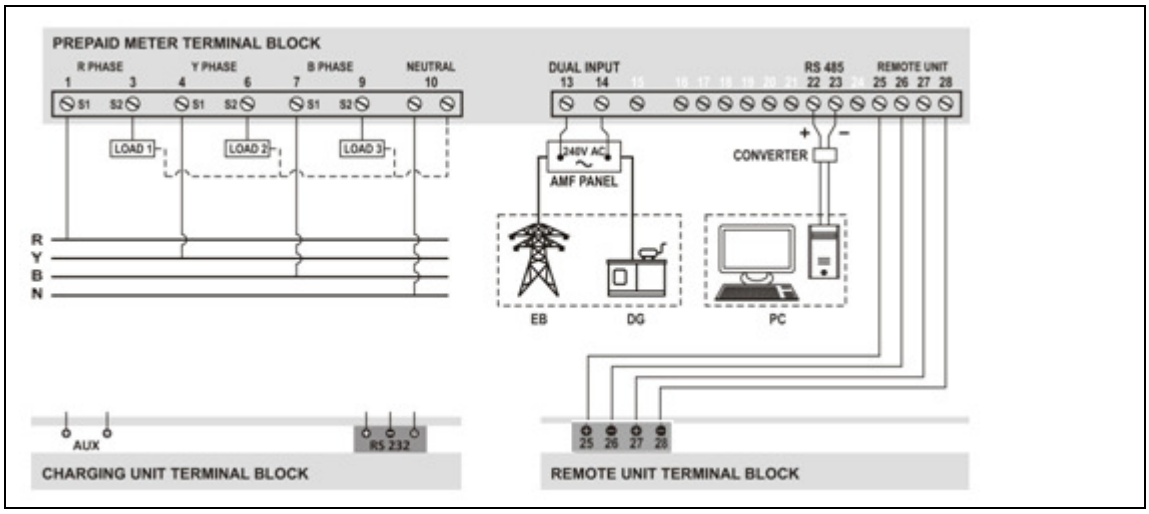


Fig2: Connection diagram for three phase prepaid energy meter with remote and charging unit



3. PREPAID METER CONFIGURATION

3.1. PREPAID METER PRODUCT DESCRIPTION

Physical Description

FRONT: The front panel of prepaid meter contains the two parts:

1. Display
2. Wiring Diagram

The Display part has one row of six digits/characters each, with auto scaling Kilo, Mega, and minus indications. Two smart keys make navigating the parameters very quick and intuitive for viewing data and configuring the prepaid meter.

The Display part of front panel contains the following indicators and controls:

7-segment LED display: One row of alphanumeric displays, six digits each, displays all parameters simultaneously. For every second the display updated.

Indicators: One row has Kilo, Mega and Minus indicators, Electricity Board, Old energy and DG indicators, communication indicator, and for Digital inputs 4 indicators(T1,T2,T3,T4) as shown in the front panel figure.

Keys: Two smart keys to scroll through the display pages.

7-segment LED display: One row, six digits, segment LED display**.** The Energy meter displays the parameter name prominently right on the large, alphanumeric readouts. In Energy all the 6 digits contains the value of parameters. In Power, Basic first 4 digits correspond to Value and remaining 2 digits corresponds to Name**.**

The Indicators-Kilo, Mega, Minus, COM and 4-D/I

KILO	**Kilo:** When lit, indicates that the reading is in Kilo (10^3). 10,000 is displayed as 10.00 K.
MEGA	**Mega:** When lit, indicates that the reading is in Mega, (10^6). 10,000 K is shown as 10.00 M. and 1.0 M as 1000 K.
MINUS	**Minus:** When lit, indicates that the reading is **negative.** When PF (power factor) is lead (capacitive load): Both PF and VAR (reactive power) sign will be negative. When current is reversed: W (active power) of that particular phase is negative.
	**EB:** EB indicator blinking indicates that meter running on electricity coming from Electricity board.
OLD	**OLD:** OLD indictor indicates the old energy values for both EB and DG separately.
	**DG:** DG indicator blinking indicates that meter running on Digital Generator.
	**COM**: Communication indicator indicates the meter communicating with the software or not.
T3 T1 T4 T2	**D/I (T1, T2, T3, and T4):** These four LEDs represent gas and water meters connected to the prepaid meter.
	**Pulse output:** This is the blinking LED indicates the load pattern. It produces 1000 pulses / kWh for 10/60A meter.
	**(W1, W2, W3, and W4):** These four LEDs represent WIFI status. These four LEDs intermittent on and off wifi reset condition, W1 and W3 not connected to the access point, W3 for Wifi communication.

LED indications for prepaid meter

LED Status	Meaning
KILO ON	Kilo
MEGA ON	Mega
MINUS(-) ON	Lag
MINUS(-) OFF	Lead
EB ON	Meter displays EB energy
OLD ON	Old energy values for EB and DG separately
DG ON	Meter displays DG energy
EB LED Blinking	Meter is running in EB
DG LED Blinking	Meter is running in DG
T1 ON	Gas meter1
T2 ON	Water meter1
T3 ON	Gas meter2
T4 ON	Water meter2
W1	WIFI Status
W2	WIFI Status
W3	WIFI Status
W4	WIFI Status
COM ON	Meter Communication with software

The second part of front panel of prepaid meter is wiring diagram as shown in the section 2.2

Models and Display parameters of Prepaid meter

Model	Display Parameters
PE5120 – Three phase Prepaid meter with internal contactor	• Credit left in kWh Units(balance) • Cumulative kWh(EB & DG) • Digital Inputs(for Gas and Water meters) Cumulative Old KWh(EB & DG) • Digital Inputs Old (for Gas and Water meters) • Voltage(Average & phase wise) • Current(Average & phase wise) • Frequency • Watts(Average & phase wise) • VA(Average & phase wise) • PF(Average & phase wise)
PE5121 – Single phase prepaid meter with internal contactor	• Voltage • Current • Frequency • Watts • VA • PF • Cumulative kWh • Cumulative kWh(EB & DG) • Credit left in kWh Units(balance) • Digital Inputs (for Gas and Water meters), Cumulative Old KWh (EB & DG), Digital Inputs old (for Gas and Water meters)

3.2. PREPAID METER OPTIONS

- Three phase PE5120, Single phase PE5121
- RS485 to connect to the remote terminals
- Postpaid or Prepaid
- Dual Source
- Direct Current 5/20A, 10/60A (default), 20/80A and CT operated---/5A
- Remote display unit enables the individual customer to monitor consumption
- With RTC option
- GSM / GPRS option
- Integration of Gas and Water (Up to 4 channel for 5120 and up to 3 channel in for PE5121) with the electrical parameters thereby, extending the flexibility for the user to budget expenses

4. PREPAID METER OPERATION

The meter is suitable for Three-phase four wire (PE5120)/ Single Phase 2 wire system (PE5121).

Meter measures electrical energy consumed and decrements the available credit register in accordance with the energy consumption-KWh or kVAh. The available credit register is incremented as and when payment is made. Meter continuously calculates the balance credit against the consumption.

As the balance credit decreases beyond the pre-defined level, a switch (latching relay) is used to disconnect the supply to the load. Meter display starts blinking when the credit balance falls to a programmed value.

Over voltage (OVER.VOL) Tripping: This is the unique feature from the Elmeasure meter to protect the equipment when the over voltage occurs. When the Line voltage is more than programmed value the prepaid meter trips the load, thus protecting the house hold equipments. This replaces the need for over voltage relays in individual houses.

Over.KVA (EB or DG): Elmeasure meters have the unique feature to program the set limit for consumption when it is operating on EB and DG in terms of kVA. When the consumption is above the set value then the LOAD gets disconnected for a span of 1 minute (programmable through configuration) after which the LOAD gets connected for the SET DELAY time to see the load is reduced and if the consumption is still higher it trips the load for the 2nd delay time (programmable) and this process gets repeated with the different programmable delay time until the consumption is reduced.

DG SELECTION: Elmeasure prepaid meter has great optional feature i.e. individual phases on for DG (R, Y, B or RYB or No DG). This feature can avoid ACCL to individual houses.

COMMUNICATION SETTINGS:

Protocol	Modbus RTU
Data bits	8
Baud rate	9600 Baud, User set 1200 to 19200 Range:1200, 2400, 4800, 9600, 19200 Normal use: 9600 Baud Noisy, EMI, RFI, long data cable: 4800/2400 Baud Short cable (< 300 meters or 975 feet): 19200 Baud
Parity	Even/odd/no
Device ID	1
Stop bit	1

4.1. KEY FUNCTIONS

Smart Keys

Operating the energy meter is easy, using the two smart keys to navigate through the display pages. The display shows where you are headed.

Smart Keys Functionality

Key	In SET (Programming) mode	In RUN (Measurement) mode
UP	To select the value and accept the value.	To scroll pages in upward direction to look at different parameters.
DOWN	To edit the value/system type down-ward in edit mode and scroll through the parameters.	To scroll pages in downward direction to look at different parameters

4.2. Wi-Fi RESET OPTION

Step	Actions	Display Reads	Range/Options/Comments
1	Press UP & DOWN keys together to enter SETUP	[SETUP]	
2	Press DOWN key	Row: 0000 PW with first digit "0" blinking	
3	Press DOWN key until it reaches the first digit to "9".	PASSWORD = 9900 (default/factory set).	If any other password is already set using DOWN key to set the right password
	Press DOWN key	R o w : S A V E "Y" Row : "Y" blinking.	If "**n**"(no) is selected then Meter enters into RUN mode without reset WiFi module. If "Y" is selected meter enters in to wifi reset mode .

4.3. PROGRAMMING GUIDE FOR 3PHASE (PE5120)/1PHASE (PE5121) PREPAID METER

Step	Actions	Display Reads	Range/Options/Comments
1	Press UP & DOWN keys together to enter SETUP	[SETUP]	
2	Press DOWN key	Row: 0000 PW with first digit "0" blinking	
3	Press DOWN key until it reaches the first digit to "1".	PASSWORD = 1000 (default/factory set). **[PASSWORD = 9900 For wifi reset]**	If any other password is already set using DOWN key to set the right password
4	Press UP key four times to accept the password.	Display element	Defines the power system configuration Options: STAR/DELTA
5	Press UP/DOWN key to select STAR/DELTA	Display: Star EL	(Selected mode blinks.)
6	Press DOWN key to accept	Display: selected system type stabilized	
7	Press down key	PT. Pri (PT primary) First digit blinking can be edited using UP/DOWN key.	

8	Press UP key to accept the edited value for first digit.	Display: 415.0P.P. Second digit blinking can be edited using UP/DOWN key. Press UP key to accept the edited value. Continue the same method until fourth digit.	Program range for PT primary :100V to 999kV If value set is above this limit, Display returns to the maximum PT Primary value acceptable.
9	Press UP key	Display: PT primary Decimal point blinking can be edited using UP/DOWN key. Certain the correct scale (Kilo/Mega) is selected. Kilo/Mega is placed on the right hand side of the display as K/M. Press UP key to accept the edited value.	E.g.: To set 11.00kV Set first four digits (1100) as explained above press UP/DOWN key to place decimal point at appropriate location. Letter K/M will indicate the Kilo/Mega.
10	Press DOWN Key to go to the next parameter.	Display: 415.0.P.S Follow the procedure as describe in steps 9 to 11.	
11	Press DOWN key	Display: CT PRI (CT Primary) 0.000 C.P	Program range For CT Primary: 0.5A to 99kA. If value Set is above this limit, display returns to the maximum CT primary value acceptable.
12	Press DOWN key	Display: CT SEC (CT Secondary) 0.000 C.S	Program range For CT Primary: 0.5A to 6A. If value Set is above this limit, display returns to the maximum CT Secondary value acceptable.
13	Press UP key four times to accept the password.	Row: 2056 Yr (RTC year) 2056 Yr (Default)	Defines the RTC year setting.
14	Press UP key to select the RTC year.	Row: 2056 Yr “56” will start to blink and it can be edited using DOWN key.	Egg: Year need to be set as 2014 so press the Up key, the selected mode will start to blink i.e. “56” and change the selected mode to “14” using DOWN key.
15	Press UP key to select the RTC year	Row: 2014 Yr Default: 2056	Program Range for RTC year :2012-2056 If year is set 2014, display return to RTC year acceptance.

16	Press DOWN key to go to the next parameter	Row: 01.01. d	Defines the Month & Date of the clock. First two digits define the month selection & another two digits mention the date.
17	Press the UP key to select the Month & Date	Row: 01. 01. d (default). First two digits blinking which is “month” selection can be edited using down key.	Selected mode will blinks and it can be set to the desired range using Down key. Eg: Month need to be set April , set the selected blink value as “04” using DOWN key
18	Press UP key to accept the edited value for month.	Row: 04.01. d Second digit blinking which is “Date” selection, it can be edited using DOWN key. Press UP key to accept the edited value.	
19	Press DOWN key to go to the next parameter	Row: 00.01. t (Default)	It defines the RTC time settings. It is in HH:MM format.
20	Press the UP key to select the Hour & Minute.	Row: 01.01. t Follow the procedure steps 8 & 9 for set the Hour & minute.	
21	Press DOWN key to go to the next parameter	Row: 52.00 Eb (Default in 3phase). 17.50 Eb(Default in single phase) Over KVA EB	It defines the over KVA tripping value for Eb. Range: up to 9999 Mega
22	Press UP key to select the over KVA value.	Row: 52.00 Eb. First digit starts blinking can be edited using DOWN key.	(selected mode blinks)
23	Press UP key to accept the edited value for first digit.	Row: 52.00 Eb Second digit blinking, can be edited using DOWN key. Press UP key to accept the edited value. Continue the same method until fourth digit.	Program range for Over KVA: 52.00 Kilo- 9999.0 Mega.
25	Press DOWN key to go to the next parameter	Row: ryb dG. (Default) Phase selection in DG (**only in 3 phase meter**)	It defines which phase needs to be work in DG. Ranges: ryb,r,y,b

26	Press UP key to select the edited value.	Row: ryb dG. Selected mode blinks and select any of the phase selection as mentioned in the range using DOWN key. Press UP key to accept the selected mode.	
27	Press DOWN key to go to the next parameter	Row : display 285.0 O.V (over voltage) 285.0 O.V (Default)	Defines the over voltage settings between Line to neutral. Range: 80-310 V
28	Press UP key to select the over voltage value	Row: 285.0 O.V (Over Voltage) First digit blinking can be edited using DOWN key.	(selected mode blinks)
29	Press UP key to accept the edited value for first digit.	Row : 285.0 O.V Second digit blinking, can be edited using DOWN key. Press UP key to accept the edited value. Continue the same method until fourth digit.	Program Range for Over Voltage : 80V to 310V If value set is above this limit, display returns to the maximum O.V value acceptable.
30	Press DOWN key to go to the next parameter	Row: 5.000 d.t (Delay Time). Follow the procedure as described in steps 5 & 6 5.000 (default)	It defines the delay time for relay tripping Range: 1-180 sec
31	Press DOWN key	Row : 9600.b (Baud rate) Communication Speed (9600-Default / factory set)	Defines the Baud rate Option: 2400, 4800, 9600, 19.2k.
32	Press DOWN key	Row : EVEn P (Parity) Even/ Odd/ None	Even(even)/ Odd(odd)/ No(No parity) (Internal Communication error Check)
34	Press DOWN key	Row : 1.000 Id(Device ID) 1.000 (Default)	Defines the ID. Communication identification Number. Option :1- 247
35	Press DOWN key	Row: ------ (Password). User Programmable password, range 1000 to 9999.	If the password is forgotten the meter will be reset and calibrated at factory only.
36	Press DOWN key	Row : rESO E.S (Energy Selection) rESO (Default)	Option: resolution/counter (rESO/COUN).Energy value format i.e., the energy accumulated in the meter to be displayed in resolution or counter format

37	Press DOWN key	Row : 5.000 A.t. (Auto scroll time)5.000 (Default)	Range: 1 to 10 seconds Display increment during auto scroll.
38	Press DOWN key	R o w : S A V E Row 2: "Y" blinking.	If "**n**"(no) is selected then Meter enters into RUN mode without memorizing any edited Values in the setup

The List of parameters that can be configured and the range is given below

Sl. No.	Parameter	Default setup	Range
1	Over Voltage(L-N) [O.V]	285.0	80V-310V
2	Over KVA	52.00	52-999K
3	Individual phases change on DG	RYB	R (or) Y (or) B (or) RYB (or) No DG
4	Delay Time [d.t]	5.000	1-180s
5	Baud rate [b]	9600	2400 to 19.2k
6	Parity(P)	EVEn	Even/ Odd/ no
7	Device Id (I d)	1.000	1.000 to 247.0
8	Password	1000	1000 to 9999
9	Energy selection mode [E.S]	rESO	rESO /COUП
10	Display increment time during auto scroll [A.t]	5.000	1 to 10 seconds

Enabling and Disabling of Auto scrolling:

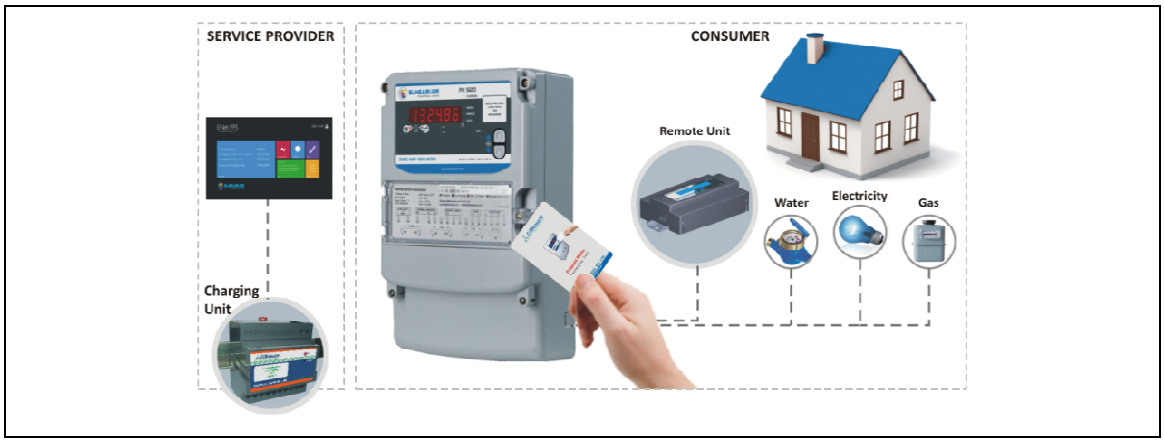
Enabling Auto Scrolling: Press DOWN key continuously for 5 seconds or until display shows EnAb.Au for downward scrolling. The auto scrolling will be enabled automatically when the meter is OFF and ON.

Disabling Auto Scrolling: Press UP/DOWN key to disable auto scrolling. Display shows dlSA.Au and returns to normal mode.

4.4. PREPAID OPTIONS

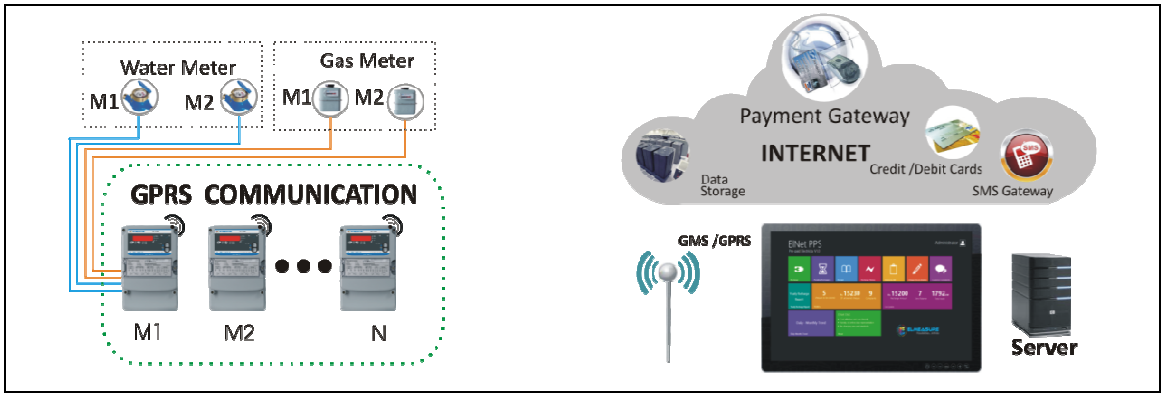
RF based

- Secured Encrypted RF Smart Card based recharging
- Elmeasure encryption also added for improving the security
- Can have multiple card- one with low value charged for emergency
- Over KVA tripping when the meter is running in DG (programmable through the smart card)
- Reconnection time is programmable-10sec, 1 min, 10 min, 2 hrs. monthly fixed charges based on KVA/KW
- RTC option available: Holiday and night time cutoff prevention, Grace amount can be set from factory, Option of programming for non tripping during week end



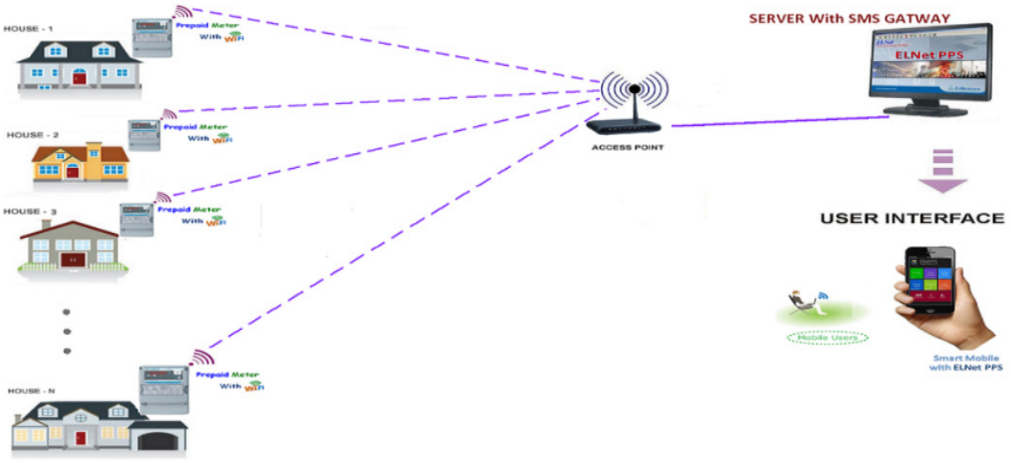
GSM/GPRS based

- Recharging with the secure authentication code and secure reply
- Meter with Real Time Clock (RTC option)
- Sends power outage & power resumption timings with date & time stamp after the power resumes to the server
- Response for all the successful, failure recharge with the reasons
- Force ON and OFF the load through SMS (Resets with the power cycle)
- Remote configuration of unit cost (cost per KWh) and the slab wise cost
- Remote Configuration of change in Threshold, Negative balance, Tariff in the secure mode
- Initiate the SMS when balance reaches the 20% or 15% of the threshold value
- Information like profiling, recharge history can be available through smart mobile applications
- Avoids Remote display



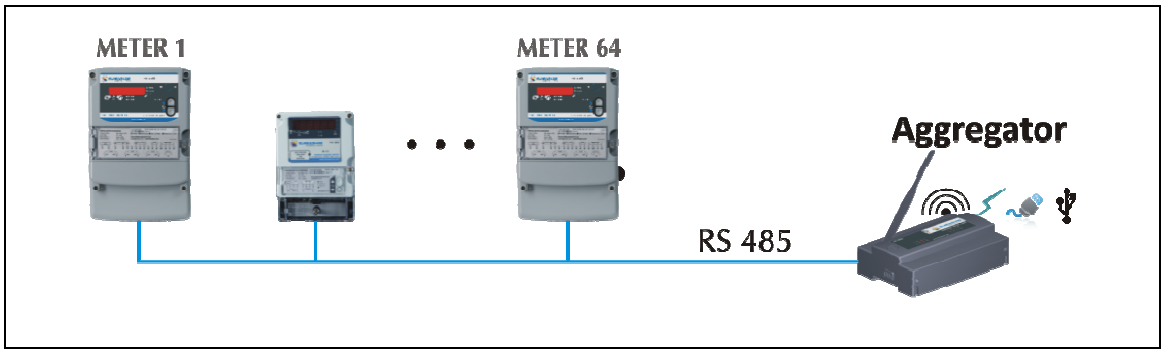
WI-FI based

- Recharging with the secure authentication code and secure reply
- Meter with Real Time Clock (RTC option)
- Sends power outage & power resumption timings with date & time stamp after the power resumes to the server
- Response for all the successful, failure recharge with the reasons
- Remote configuration of unit cost (cost per KWh) and the slab wise cost
- Remote Configuration of change in Threshold, Negative balance, Tariff in the secure mode
- Initiate the message when balance reaches the 20% or 15% of the threshold value
- Information like profiling, recharge history can be available through smart mobile applications
- Avoids Remote display



RS485 with Aggregator

- Cost effective solution
- Aggregator collects information and transfer data through Ethernet/Wifi/USB/GPRS to the server
- ELNet billing software for profiling



Aggregator-AG 1000

Aggregator AG1000 is a web based high end data concentrator and All-In-One multi protocol communication interfacing unit that supports the Modbus protocol and has different types of communication channels. Introduction of the Aggregator allows for flexibility to cater to wired or wireless environments with built in storage, providing the end user with a robust solution of Energy Management. One of the major advantages of AG1000 is the data storage capacity of upto 64GB which can be transferred to a remote server at pre-defined time intervals that allows for built in data redundancy. Data for 64 devices recording 62 parameters each at 1 min intervals can be stored for up to 5 years. The same data can be directly viewed and can also can be pushed to the cloud with the built in web server software, enabling the user to collect and monitor the system without the system without geographical boundaries. Communication channels of RS485, Ethernet, Wi-Fi, Zigbee and GPRS (2G & 3G) are available in the unit.

Key Features:

- Rugged construction meet harsh industrial environments
- Data reliability improved through redundancy
- Isolated communication channels for better safety and reliable operation
- Data can be pushed to the cloud server for integration with customer end applications
- Flexible installation can be configured to match the customer requirements
- Remotely monitoring- generate alarms in case of any error
- Signal strength notification for easy installation and maintenance
- Compact construction –Din rail and wall mountable

Communication channels available in AG1000:

- RS485 with Isolated wired
- Ethernet wired
- Wi-Fi wireless
- Bluetooth Wireless
- Zigbee Wireless
- GPRS (2G & 3G) wireless

4.5. PREPAID FUNCTIONS

- Advanced collection of revenue before electrical power consumption.
- Charging the meter with credit revenue through multiple options (Smart card or Wired or GSM/GPRS).
- The loaded revenue decrements based on the rate of electricity at that time (Currency/unit), which may change from time to time.
- Provides visible and audible alarm to the user when the credit balance falls to a particular value at the meter as well as at the remote display unit (Optional).
- Secured transactions, bill and report generation.
- The implementation of prepayment accounting functions can be separated into credit and charge functions. The credit functions include:
  1. Token credit function
  2. Emergency credit function

Two types of charge functions are implemented:

1. Consumption-based tariff charges
2. Time-based auxiliary charges

Token credit function:

Token Credit function deals with managing credit registers according to credit token transfer. When credit transfer is accepted, the values of "Available Credit Register" and "Total Purchase Register" are increased for the amount credit transferred.

Emergency credit function:

Emergency credit function is used in situations when "Available Credit Register Value" approaches or goes under zero. For this purpose, three parameter objects are implemented:

1. Emergency Credit Initial Limit
2. Emergency Credit Limit
3. Emergency Credit Threshold

"Emergency Credit Initial Limit" is used once after meter installation for the purpose of enabling the customer to make the first buy (or transferring the first credit from the management centre). It defines the credit value which is available when emergency credit is first selected by the customer.

"Emergency Credit Limit" defines the credit value which is available after the value of "Available Credit Register" reaches zero and the customer selects the emergency credit.

"Emergency Credit Threshold" defines the positive value of "Available Credit Register" at which the meter begins to notify the customer that the credit will expire. When the value of "Available Credit Register" falls below the value of "Emergency Credit Threshold", the meter starts notification.

5. FEATURES OF PREPAID METER

5.1. COMMON FEATURES

- User friendly, compact wall mounting design
- Dual source measurements up to 80A whole current/CT operated
- Currency based recharging for EB, DG, Gas and Water (Up to 4), pricing can be programmed independently
- No separate EB and DG recharging
- Displays and communicates balance, VLL, VLN, A, F, W, PF, VA, KWh EB and DG, Gas and Water input pulse
- Tripping of EB or DG consumption at pre-determined set point for protection and effective use of energy
- Current Limiting facility for DG/EB separately
- History of recharge
- Protect your equipment against overload/over voltage/harmonics
- Selection of DG powers either 3phase or single phase programmable at site- replaces ACCL & minimize wiring complexity
- Over voltage protection at 285v default (programmable at site)
- Display blinks in the frequent interval to indicate low balance
- EB to DG to EB changeover through 240V AMF / RS485 communication
- For DG phase wise (R or Y or b or RYB or No DG)
- EB over consumption limit
- Programmable Time delay
- 4DI (except RF) / 2DI
- Programmable alarm value to blink the display

5.2. OPTIONAL FEATURES

- Optional RTC
- Monthly (on programmable day)/Weekly (on day of the week) /Daily (on time) deduction programmable
- 14 programmable holidays
- 2 programmable Weekend holidays (can be programmed to any 2 days or 1day)
- Happy Hours (can be programmed to any time of the day)
- Service provider can Force off and on the load
- Emergency credit to take of residence / occupants even with zero balance
- Programmable 4 slab based on the tariff
- Programmable 2 TOD based on the time (slab programmable independently)

6. TECHNICAL SPECIFICATIONS

The following table gives the Technical Specifications of the prepaid single phase meters PE5121 / Three phase energy meter PE5120.

Parameter	Range
Connection	Single Phase,2 wire, PE5121 / Three phase, 4wire, PE5120
Accuracy	Class 1 (Default) IEC 61036, CBIP 88
Sensing / Measurement	True RMS, 1 Sec update time, 2 Quadrant Power & Energy
Voltage Burden External Fuse Rating	80- 240V Phase to Neutral 5VA Max. 60A
Current	Basic Current I_b = 10A Maximum Current I_{max} = 60A
Frequency	50Hz ± 5 %
Pulse Constant	1000 pulses/Kwh
Display Resolution	1 Rows, 6 digits (10mm height)
Operating Temperature	-10^o C to +55^o C (14^o F - 131^o F)
Storage Temperature	-25^o C to +70^o C (-13^o F - 158^o F)
Humidity	5% to 95% non condensing
Communication	RS 485 serial channel connection Industry standard Modbus RTU protocol
Baud rate	2400 bps to 19200 bps (preferred 9600 bps)

Isolation	2000 volts AC isolation for 1 minute between communication and other circuits
Gas/Water input option	Factory configurable Digital input with Maximum Frequency 3Hz for up to 4 channel or Analog Input 4-20mA or 0-20mA for 2 channel programmable at field or 1-10DC voltage
Weight (appox.) unpacked	670 gms for PE5121 / 1650 for PE5120
Shipping(packed)	750 gms for PE5121 / 1750 for PE5120
Dimensions(mm)	160 × 112 mm (Depth 58mm behind bezel)

The following table gives the Technical Specifications of the Prepaid Three phase meters (PE5120) CT operated meter.

Parameter	**Range**
Connection	3 Phase,4 wire, PE5120 CT operated
Accuracy	Class 1 (Default) IEC 61036, CBIP 88
Sensing / Measurement	True RMS, 1 Sec update time, 2 Quadrant Power & Energy
Input voltage (Measurement) Burden External Fuse Rating	4 voltage inputs(VR,VY,VB,VN) Programmable 110 or 415VLL Nominal(Range 80 to 550VLL), Primary Programmable up to 999kV 0.2VA Max. per phase 2A
Input Current(Measurement) Overload Burden	Current Inputs (AR,AY,AB) 50mA-6A(Field programmable 1A or 5A) , Primary Programmable up to 99kA for CT operated one. 10VA Max. Continuous, 50A max. for 3 sec. 0.5VA Max. per phase
CT PT Ratio Max	2000MVA programmable
Display Resolution	1 Rows, 6 digits (10mm height)
Humidity	5% to 95% non condensing
Operating Temperature	-10^{o} C to +55^{o} C (14^{o} F - 131^{o} F)
Storage Temperature	-25^{o} C to +70^{o} C (-13^{o} F - 158^{o} F)
Communication	RS 485 serial channel connection, Industry standard. Modbus RTU protocol.
Baud rate	2400 bps to 19200 bps (preferred 9600 bps)
Isolation	2000 volts AC isolation for 1 minute between communication and other circuits
Gas/Water input option	Factory configurable Digital input with Maximum Frequency 3Hz for up to 4 channel or Analog Input 4-20mA or 0-20mA for 2 channel programmable at field or 1-10DC voltage

Weight	3 phase: Unpacked-1650 gms, Packed 1850gms
Dimension Bezel	173 × 262 mm (Depth 82mm behind bezel)

7. COMMUNICATION

7.1. COMMUNICATION OPTIONS

7.1.1. RS485

The RS-485 bus standard is one of the most widely used physical layer bus designs in industrial applications. The key features of RS-485 that make it ideal for use in industrial communications and the applications are

- Bi directional communication in the single pair of twisted cables
- Multiple Driver can be connected to the same bus
- Differential communication makes it work for long distance upto 3000 feets or approximately 900 meters (depending on the cable and environment)

7.1.2. SMARTCARD

A **smart card**, **chip card**, or **integrated circuit card** (**ICC**) is any pocket-sized card with embedded integrated circuits.

The benefits of smart cards are directly related to the volume of information and applications that are programmed for use on a card. A single contact/contactless smart card can be programmed with multiple banking credentials, medical entitlement, driver's license/public transport entitlement, loyalty programs and club memberships to name just a few. Multi-factor and proximity authentication can and has been embedded into smart cards to increase the security of all services on the card.

Commercial Applications:

The smart card's portability and ability to be updated make it a technology well suited for connecting the virtual and physical worlds, as well as multi-partner card programs.

- Banking/payment
- Loyalty and promotions
- Access control
- Stored value
- Identification
- Ticketing
- Parking and toll collection

7.1.3. GSM/GPRS

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM supports voice calls and data transfer speeds of up to 9.6 kbps, together with the transmission of SMS (Short Message Service).

GPRS stands for General Packet Radio Service and is a second generation (2G) and third generation (3G)--or sometimes referred to as in-between both generations, 2.5G--wireless data service that extends GSM data capabilities for Internet access, multimedia messaging services, and early mobile Internet applications via the wireless application protocol (WAP), as well as other wireless data services.

GPRS was one of the earliest cell phone data access technologies

GPRS is the most widely supported packet-data wireless technology in the world. Like GSM, GPRS supports international roaming so customers can access data services whether they are at home or abroad. When users travel to areas that have not yet been upgraded to GPRS, they still can access many data services via circuit-switched GSM.

Features and benefits of GSM/GPRS Modem

- Designed for use at energy meter
- The modem takes readings at scheduled intervals
- Stored data is transfer in fast mode on request from central station
- SMS to predefined mobile numbers for anomalous events of meter
- Flexibility to enable reading of any type of electronic meters (pre-configured)
- Suitable for HT and LT metering installations
- Modem with built-in wide range power supply
- Sealing provision
- Suitable for wall mounting
- Connection types
  - Single meter
  - Multiple meters (Secure make) via optional multiplexer interface
- Meter connectivity through
  - Optical communication port
  - Serial RS232 communication port
  - Serial RS485 communication port (for Secure make meters)

- IP 51 compliant
- Multiple LEDs for Status indication
- SIM card holder (sliding with sealing provision)

GSM/GPRS Specification:

- Works with global Quad band. Can be used with any GSM operators
- GPRS class B mobile station
- Compliant with GSM phase 2/2- class 4 (2W @850/900 MHZ, class1 (1W@1800/1900MHZ))

7.1.4. WI-FI

Wi-Fi is a local area wireless technology that allows an electronic device to exchange data or connect to the internet using 2.4 GHz UHF and 5 GHz SHF radio waves. These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can comprise an area as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points.

Features and benefits of WI-FI

- Enable staff to carry portable Wi-Fi handsets giving them the ability to work anywhere, anytime.
- Using Wi-Fi enables PDA's and Laptops to deliver quick and easy access to information
- Eliminate cellular usage charge.
- Eliminate cabling and wiring for PC's
- Eliminate switches, adapters, plugs, pins, and connectors.
- Secure networking using the latest secure networking protocols
- Simplified management software.
- Radio Frequency sweeping technology that disables rogue and ad hoc wireless devices not relevant to the network
- Fast roaming and seamless data packet transfer
- Quality of Service or QO

7.1.5. REMOTE UNIT

A **Remote Unit** (**RU**) is a microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system by transmitting telemetry data to a master system, and by using messages from the master supervisory system to control connected objects.

Features:

- Elegant design
- Displays all parameters including balance
- No separate power is required
- 100 meter distance from the meter using CAT 5 cable
- Display blinks and buzzer on in the frequent interval to individual
- When idle state remote unit shows balance only
- Manual SET button for re-connection

Applications:

Remote monitoring of functions and instrumentation for:

- Oil and gas (offshore platforms, onshore oil wells)
- Networks of pump stations (wastewater collection, or for water supply)
- Environmental monitoring systems (pollution, air quality, emissions monitoring)
- Mine sites
- Air traffic equipment such as navigation aids (DVOR, DME, ILS and GP)

Remote monitoring and control of functions and instrumentation for:

- Hydro-graphic (water supply, reservoirs, sewerage systems)
- Electrical power transmission networks and associated equipment
- Natural gas networks and associated equipment
- Outdoor warning sirens

7.2. COMMUNICATION REGISTER MAP FOR PREPAID METER

All the parameters declared in the communication map are float and follows the standard Modbus RTU protocol. The data can be retrieved individually or together as a block.

Sl. No.	Parameter	Data type	Address
1	Watts Total	float	40101
2	Watts R phase	float	40103
3	Watts Y phase	float	40105
4	Watts B phase	float	40107
5	Reserved, communicates zero	float	40109
6	Reserved, communicates zero	float	40111
7	Reserved, communicates zero	float	40113
8	Reserved, communicates zero	float	40115
9	PF Ave. (Instantaneous)	float	40117
10	PF R phase	float	40119
11	PF Y phase	float	40121
12	PF B phase	float	40123

13	VA total	float	40125
14	VA R phase	float	40127
15	VA Y phase	float	40129
16	VA B phase	float	40131
17	VLL average	float	40133
18	Vry phase	float	40135
19	Vyb phase	float	40137
20	Vbr phase	float	40139
21	VLN average	float	40141
22	V R phase	float	40143
23	V Y phase	float	40145
24	V B phase	float	40147
25	Current Total	float	40149
26	Current R phase	float	40151
27	Current Y phase	float	40153
28	Current B phase	float	40155
29	Frequency	float	40157
30	Wh EB (if meters is manufactured for Wh), VAh EB(if the meter is manufactured for VAh)	float	40159
31	Reserved, communicates zero	float	40161
32	Reserved, communicates zero	float	40161
33	Reserved, communicates zero	float	40161
34	Wh DG (if meters is manufactured for Wh), VAh DG(if the meter is manufactured for VAh)	float	40167

8. TROUBLESHOOTING

⚠ CAUTION

During reparation and maintenance, do not touch the meter connecting clamps directly with your bare hands, with metal, blank wire or other material as you will have the chance of an electricity shock and a possible chance for health damage.

Turn off and lock out all power supplying the energy meter and the equipment to which it is installed before opening the protection cover to prevent the hazard of an electric shock.

⚠WARNING

Maintenance or reparations should be performed by qualified personnel familiar with applicable codes and regulations.

Use insulated tools to maintain or repair the meter.

Make sure the protection cover is in place after maintenance or repair

Due to programming error, site conditions, some problems can cause the Meter malfunction. The fault symptoms and their remedial action for correction is given below.

If the display does not turn ON

- Check that there is at least 110 V available in power supply
- Check the link connected or not

Recharging not happening through RS 485

- Check the connectivity for RS485
- Check the meter ID correct or not
- Check the Elnet PPS selection correct or not

Recharging not happening through RF card.

- Check the RF card serial no and meter serial no is correct or not
- Check proper PPS select or not
- Check the RF card recharge properly

Display blinking

- Balance is below the limit
- Load off condition
- Check the balance is zero
- Check the over voltage occur
- Check the over KVA occur

If RS-485 communication does not work:

- Check that the baud rate of the host computer/PLC is the same as Meter
- Check that the device ID of the meter is unique and should not replicate
- Check all communications wiring is complete
- Check that the number of data bits is set to 8, with one stop bit and even parity

9. DISCLAIMER

Sufficient care is taken to provide all information regarding the product but ElMeasure does not responsible the product which has been damaged due to improper installation, improper handling, improper connections, neglect, misuse, accident, and abnormal conditions of operation and natural calamities or acts of god.