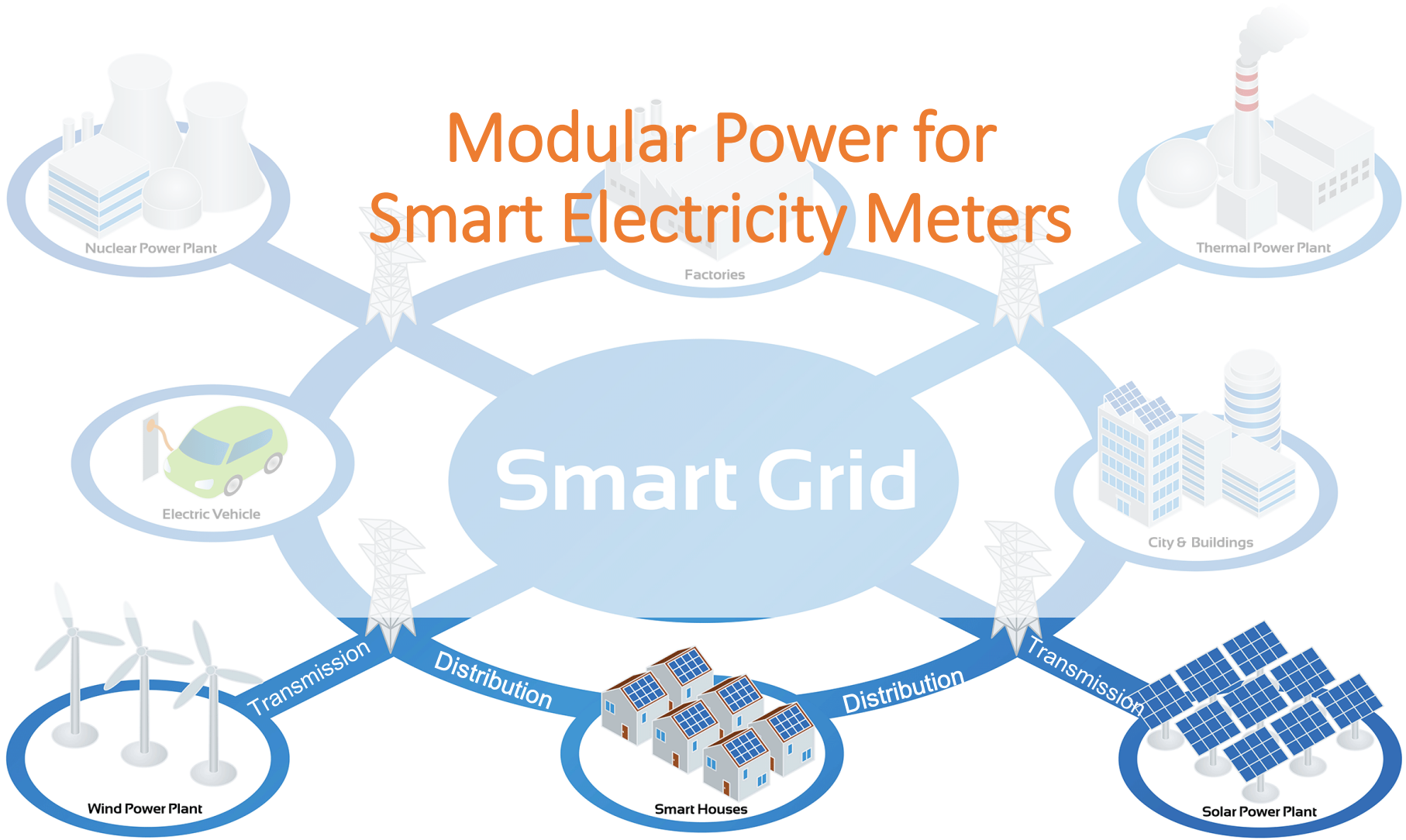
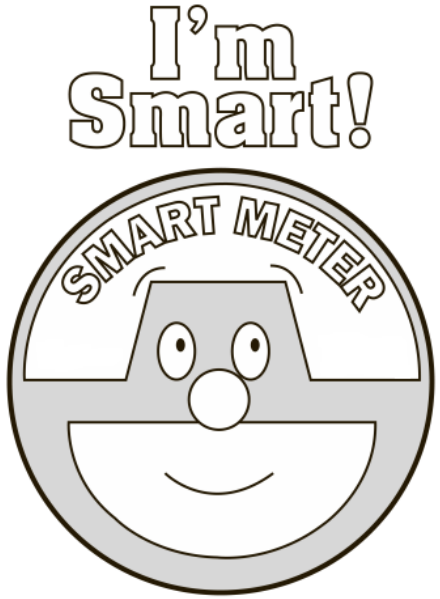
Modular Power for Smart Electricity Meters





Content

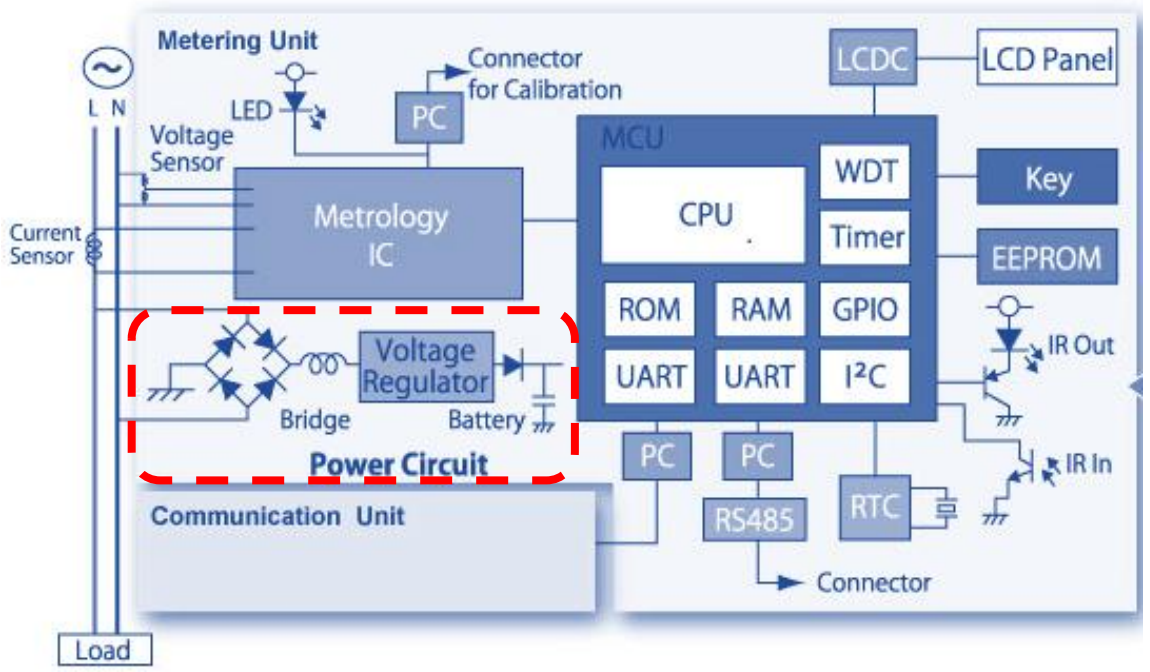
1. Block diagram of Smart Electricity Meters
2. Comparison of different Power Supply solution of main board
3. What should be considered when choose a ***suitable*** power module?
4. Mornsun Modular Power for Smart Electricity Meters

1. Block diagram of Smart Electricity Meters

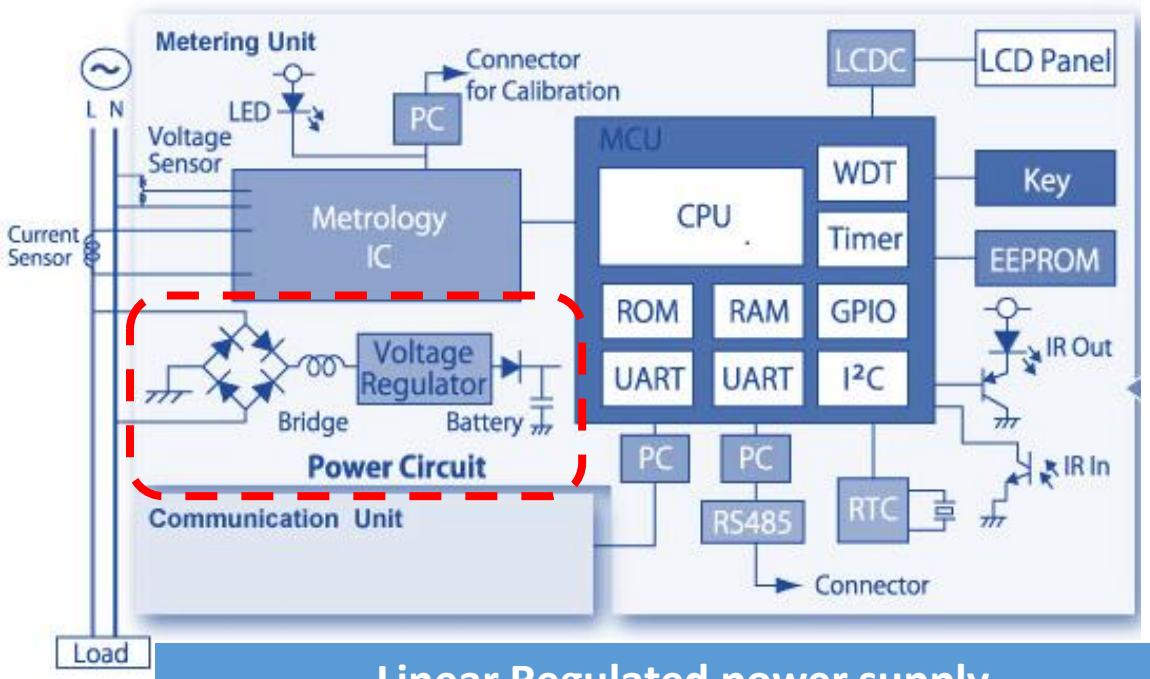
For the smart grid, the ability to run from low power levels is important. Only smart electricity meters have the luxury to have a grid power source and, even in this case, consumption must be minimized as the power to run the devices comes from the utility and not from the customer.

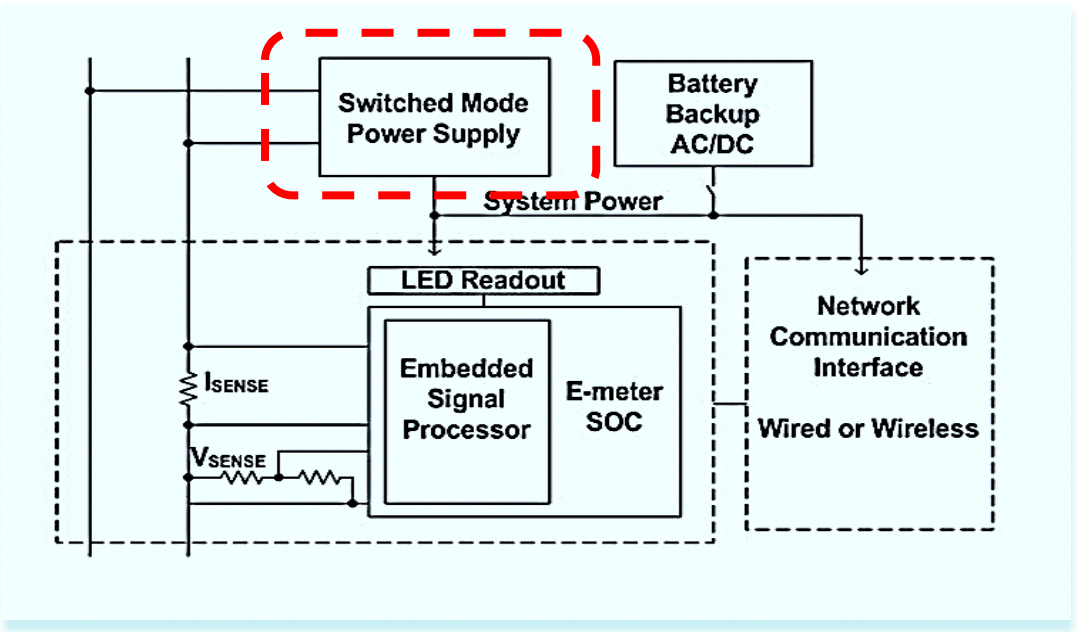
Power supply's function is to 'step down' the alternating current (AC) coming in from the utility pole power lines to the 2 to 10volts of direct current (DC) required to run the meter's digital electronics which record the electricity usage data.

A Reliable Power supply ensures
the smart meter operated stable and safety.



2. Comparison of different Power supply solutions of main board





Linear Regulated power supply	Switching Mode power supply
Easy design and manufacture	Easy to use and maintenance
Low ripple and output noise	Higher ripple and output noise than linear regulated power supplies in high frequency
Poor insulation, meter may damaged by surge	High isolation between input and output
Operation voltage range is limited	Wide and adjustable voltage and current, fast responds
Low efficiency and density	High efficiency and density
Transformer's performance will effect EMC performance and output stable	Design with EMC circuit
Poor load and line regulation	Excellent load and line regulation

3. What should be considered when choose a *suitable* power module?

When it comes to smart electricity meters, strict *standards* of smart e-meter are in place to help guarantee the safety and national/global compliance.

Smart grid is aim to save energy, so there will be requirement for the power consumption of its devices, for example, the static power consumption of the voltage line for the different type of meter should be less than or equal to 2 ~ 3W, the apparent power is less than 10VA.

---Refer to BS-EN-62053-11-2003

And as the smart e-meters will be running at the harsh environment and connecting to operator interface, there will be requirement for the temperature test and isolation.

e.g:
power consumption,
Temperature Test,
Electromagnetic Compatibility

Summary List of Tests for Electronic Meters (Solid State Type)

Test Item	IEC/AS 62052 Part 11	IEC/AS 62053 Part 21	EN50470 Part 1	EN50470 Part 3	ANSI C12.1	ANSI C12.20
General Mechanical Requirement	●	●	●	●		
Protection against Penetration of Dust and Water, Terminals - Terminal Block, Resistance to Heat and Fire, Marking of Meter, Spring Hammer Test	●		●			
Temperature Test: Dry Heat Test, Cold Test, Damp Heat Cyclic Test and Solar Radiation Test, Vibration and Shock Test	●		●		●	●
Starting Current, Test of No Load Condition, Influence of Ambient Temperature Variation, Voltage Variation, Frequency Variation, Effect of External Power Frequency Magnetic Field, Influence of Short-time Overcurrent, Influence of Self- heating, Accuracy Measurement at Different Loads		●		●	●	●
Auxiliary Voltage Variation		●				
Harmonic Component, DC and Even Harmonics, Odd Harmonics in the AC Current Circuit, Sub-harmonics in the AC Current Circuit, Reversed Phase Sequence, Voltage Unbalance, Interpretation of Test Results, Meter Constant, Operation of Accessories		●		●		
Continuous Magnetic Induction of External Origin		●	●	●		
Immunity to Earth Fault	●			●		
Power Consumption		●		●	●	●
Fast Transient Burst Test, Immunity to Electromagnetic RF Fields, AC Voltage Test	●	●	●	●	●	●
Immunity to RF-conducted Disturbances	●	●	●	●		
Radio Interference Suppression, Voltage Dips and Short Interruptions, Surge Immunity Test, Impulse Voltage Test, Heating ESD	●		●		●	●
Damped Oscillatory Waves Immunity Test	●		●	●	●	●
Maximum Permissible Error, Durability, Reliability				●		
Salt-Spray and Rain-tightness Test					●	●

3. What should be considered when choose a ***suitable*** power module?

Comply to the smart e-meters standard , designers must consider a host of factors when choosing the ***best power supply*** for the system. Some of these include *input range, output voltage and power, standby power, temperature, EMC and space constraints.*
Understanding how various power supplies compare to one another in terms of each of these factors will enable equipment designers to make the right design decision for the project at hand.

- ✓ Requirement of Standards
- ✓ Safety and Reliable
- ✓ Design Flexibility
- ✓ Power density

Performance Factors to be considered

Input voltage range: The power supply voltage and frequency are different in different countries. Their specifications in some major countries are as given in the following table. Having a wider input range covers most of the countries' translates to much greater flexibility for unforeseen design iterations requiring higher input voltages or the need to develop several versions of the same basic equipment model-**All in one.**

Name of country (or region)	Power supply voltage		Frequency
Japan	Single phase, 100/200V	Three phase 200V	50Hz/60Hz
USA	Single phase 115/230V	Three phase 230V	60Hz
South Korea	Single phase 110/220V	Three phase 200V/220V/380V	60Hz
Hong Kong	Single phase 200V/220V	Three phase 346V/380V	50Hz
China	Single phase 220V	Three phase 380V	50Hz
Philippines	Single phase 115/230V	Three phase 240V/480V	60Hz
India	Single phase 230V	Three phase 240V/415V	50Hz
Norway	Single phase 220V/230V	Three phase 380V	50Hz
Sweden	Single phase 230V/400V	Three phase 400V/690V	50Hz
Germany	Single phase 230V	Three phase 400V	50Hz
Portugal	Single phase 230V	Three phase 400V/480V	50Hz
United Kingdom	Single phase 240V	Three phase 415V	50Hz

Isolation : Compared to industrial power supplies, the levels required for electricity power supplies are much stricter.
As the alternating current (AC) coming in from the utility pole power lines is much higher, isolation is required between the ac input, internal high-voltage stages and dc output in order to prevent electrical shock.

Standby power: Designers must consider of the power consumption of the power supply to ensure the whole system of the meter can meet the standard requirement.

Environmental factors: Smart e-meters will be running at the harsh environment, there are requirements of the operation temperature and influence of self-heating, therefore, operation temperature of -40℃ to +70 ℃ /-40 ℃ to +85 ℃ ,which offering a substantial improvement in design flexibility.

Electromagnetic Compatibility (EMC) : power supply is the heart of the device to ensure the system running well, due to this reality, electromagnetic compatibility is another area that is regulated by standards and tested for performance. e.g. Radiated radio-frequency electromagnetic field immunity (RFEMS) .

Mornsun Modular Power for Smart Electricity Meters

LS03-16BXXSS

- *Ultra wide input voltage rang: 90~528VAC/100~745VDC*
- *AC and DC dual-use(input from the same terminal)*
- *Operating temperature range: -40℃to +85℃*
- *Compact size, high power density*
- *Isolation voltage: 4K VAC*
- *Output short circuit, over-current protection*
- *Meets UL60950, EN60950, FCC part 15 standards(Pending)*

LD03-16BXX

- *Ultra wide input voltage rang: 90~528VAC/100~745VDC*
- *AC and DC dual-use(input from the same terminal)*
- *Operating temperature range: -40℃ to +70℃*
- *Compact size, high power density*
- *Isolation voltage: 3K VAC*
- *Output short circuit, over-current protection*
- *Meets UL60950, EN60950, FCC part 15 standards(Pending)*

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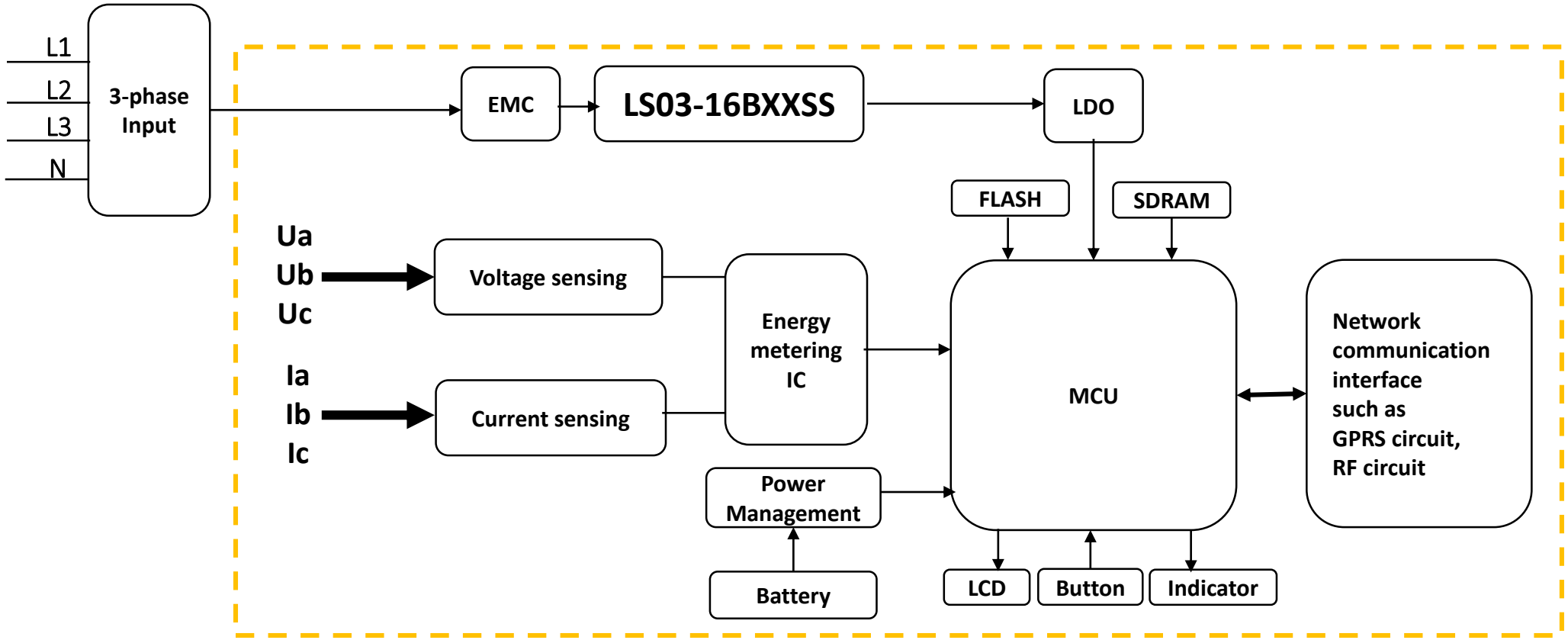

Smart meter block diagram

LS03-16BXXSS 'step down' the alternating current (AC) coming in from the utility pole power lines to isolated 5/9/12/15/24V to run the meter's digital electronics which record the electricity usage data.

Mornsun Modular Power for Electricity Metering Equipment

There are two methods to connect the Electricity metering equipment to the power grid, directly or via the voltage transformer. According to IEC 62052-11:2003,input power to the Electricity metering equipment is as low as 60V,.LO10-26D0512-04 can accept input voltage of 65~460VAC covers the requirement of standard, single phase and three-phase.

LO10-26D0512-04

- *Ultra wide input voltage rang: 65~460VAC/90~650VDC*
- *Isolation voltage: 4K VAC*
- *Conduction/Radiation: Class B*
- *Burst/Surge: Class 4*
- *High efficiency, high reliability, low ripple & noise*
- *Low standby power consumption*
- *Input over-voltage,Output short circuit, over-current, over-voltage protections*

More information please visit
www.mornsun-power.com