

**Single-Phase Energy Meter Reference Platform**  
**Software - High Level Design Specification**  
Ver1.0

*Note: This document may subject to change by Renesas Technology Singapore without prior notice.*



# TABLE OF CONTENTS

<b>1 PERIPHERAL INTERFACES</b> .....	<b>1</b>
1.1 PERIPHERAL INTERFACES FLOW: .....	2
<b>2 MAIN PROCESS</b> .....	<b>3</b>
2.1 MAIN PROCESS FLOW: .....	4
2.2 ADC INTERRUPT SERVICE ROUTINE: .....	5
2.3 CALCULATION ROUTINE (AT EVERY 120MS) .....	6
2.4 FRAME ROUTINE (EACH FUNCTION AT EVERY 1.2S) .....	7

# Software High Level Design Specification

---

## 1 Peripheral Interfaces

This is the process linked with all the peripherals and analog circuits. Some of the interfaces are described as follow:-

### a. Power Down Logic:

Power shutdown logic used to generate interrupt when power goes below certain level. This interrupt is used to save important variable in EEPROM.

### b. LED:

- Power LED: which is used to indicate presence of power of the system.
- ELT LED: used to indicate earth leakage
- Reversal LED: used to indicate reverse current
- KWH LED: Used to indicate KWH pulse

### c. Serial Communications:

Calibration and collection of data is done through optical/RS-232 communication.

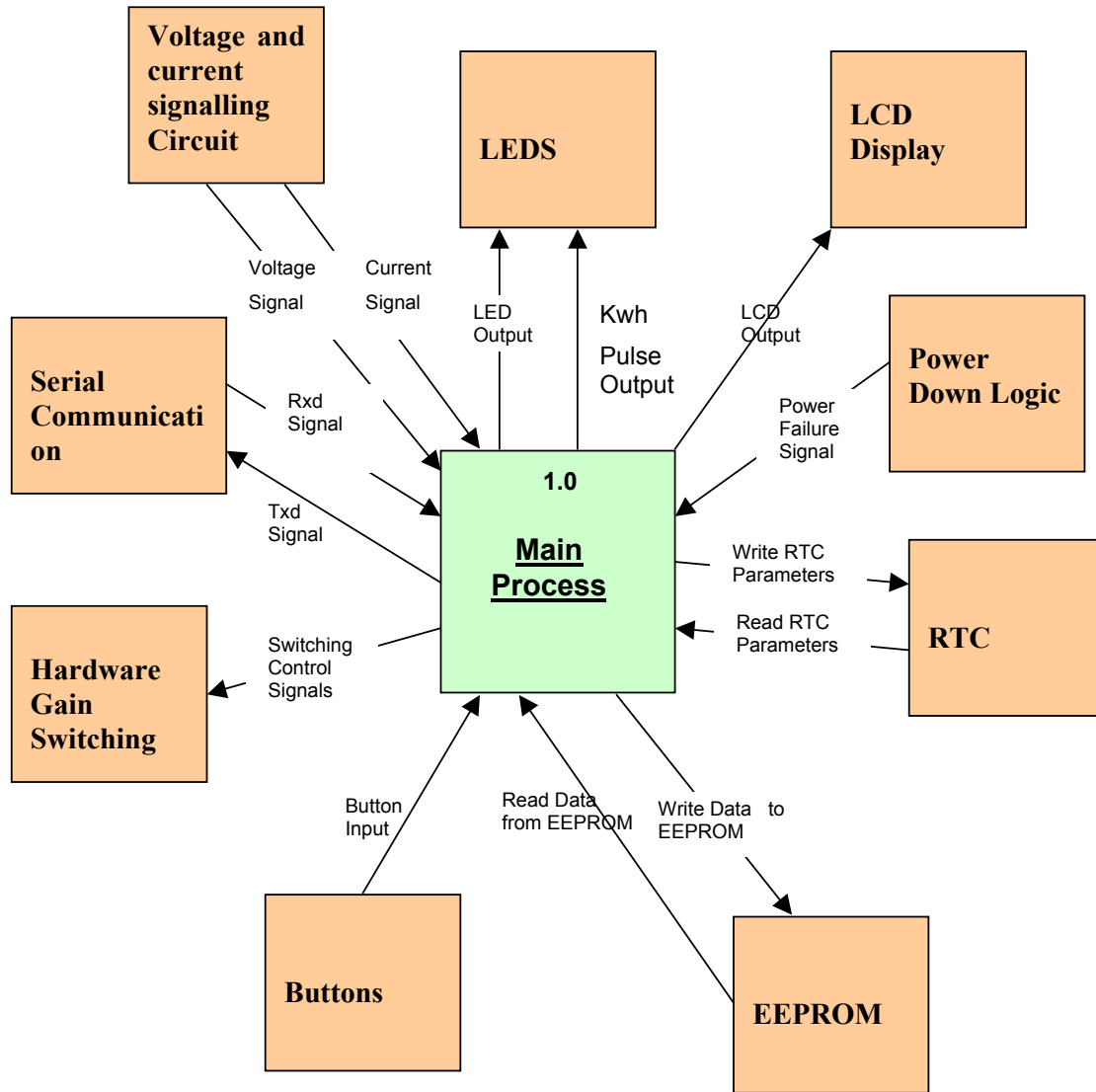
### d. Buttons:

- MD Reset button: To take the back up of the MD, energy etc.
- Up button: This can be used to scroll up the LCD display.
- Down button: This can be used to scroll down the LCD display.

### e. LCD Display:

- Controller shall use the on chip display driver to drive the 18 x 4 segment display
- Display shall be use to display Kwh, KVArh, MD, EL, REV, Volt, Amp, Comm, LOW BATT

### 1.1 Peripheral Interfaces Flow:



## 2 Main Process

### Functions provided by the module:

#### a. Power On Process:

- Initialise all MCU modules (ADC, SCI, ports, Timer, RTC)
- Clear RAM
- All the calibration coefficients and Cumulative energy is read from EEPROM and transferred to respective RAM locations.

#### b. ADC Interrupt Routine:

- ADC will sample 3 channels. They are 2 channels for currents (Phase and Neutral) and one Voltage channel by 10-bit ADC.
- Delta Sigma ADC:
  - For one ADC channel sampling, conversion time is 32.5us at 9.8304MHz clock frequency; Input analog signal shall be maximum 3.3V Peak to Peak.
- 10-bit ADC:
  - For one ADC channel sampling, conversion time is 6.3us at 9.8304MHz clock frequency.

#### c. Sampling Order:

- **First Sample:**
  - When start of conversion bit is enabled, first Current (either Phase/Neutral) sample shall be taken, after 32.5us (for 9.83MHz) ADC will assert the end of conversion bit. Then Store the result.
- **Second Sample:**
  - Next Current can be taken for sampling. After 32.5 us, the value of the second current is stored.
- **Third Sample:**
  - Voltage is sampled after a programmable delay, after the first current is sampled. The free time in between the end of storing the result of second current sample and the start of conversion of voltage can be used for some calculations.

#### d. Serial Communication and Calibration:

The meter shall have two modes:

- **Calibration Mode**

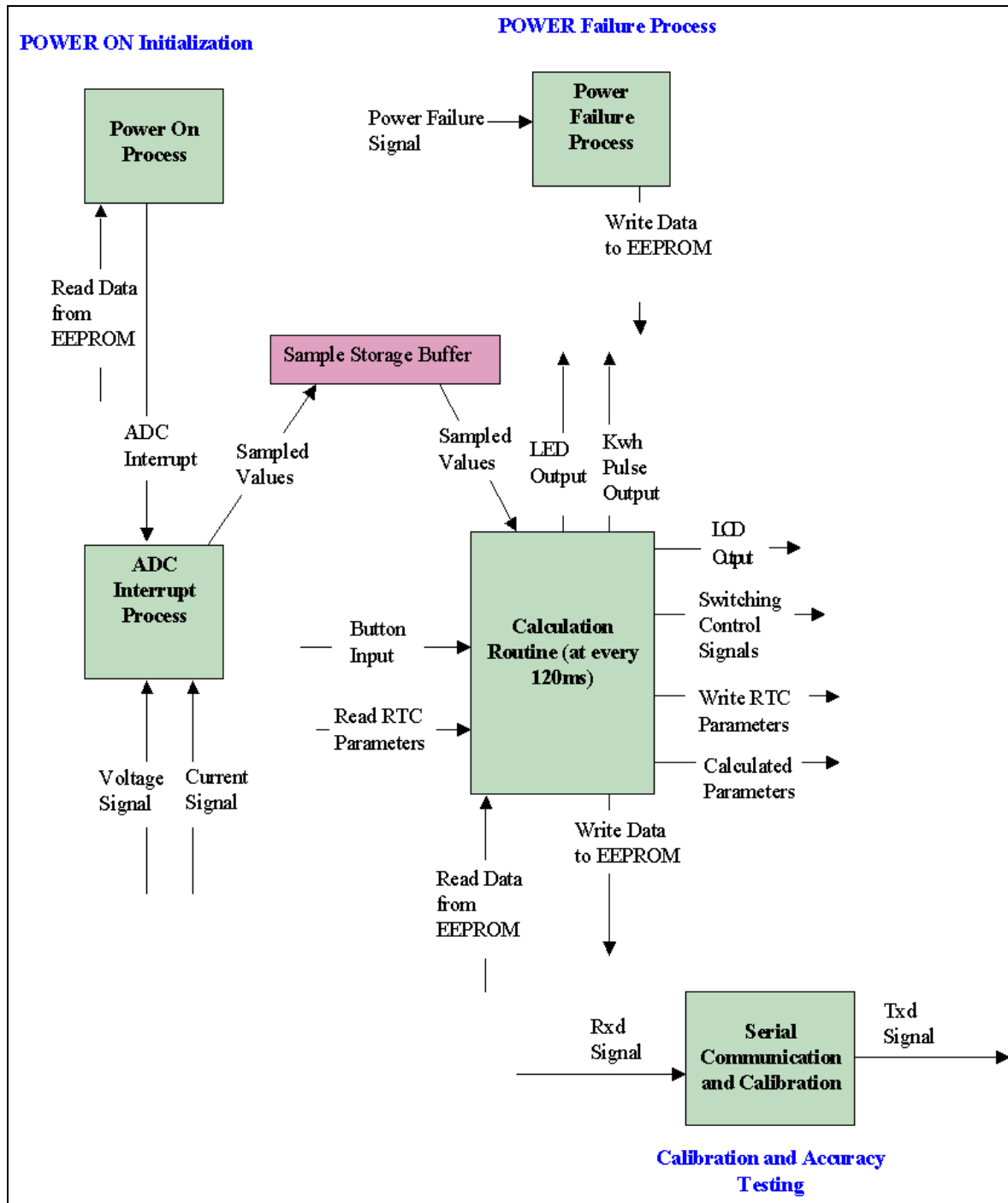
In calibration mode Active Energy (CT error angle, gain), Voltage and Current (to calibrate apparent energy) will be calibrated. Calibration values will be stored in specified area of EEPROM. These values can be written and read when meter is in calibration mode.

The meter shall perform the software calibration through RS-232 or optical port (infrared interface) using IEC 62056-21 protocol.
- **Programming Mode**

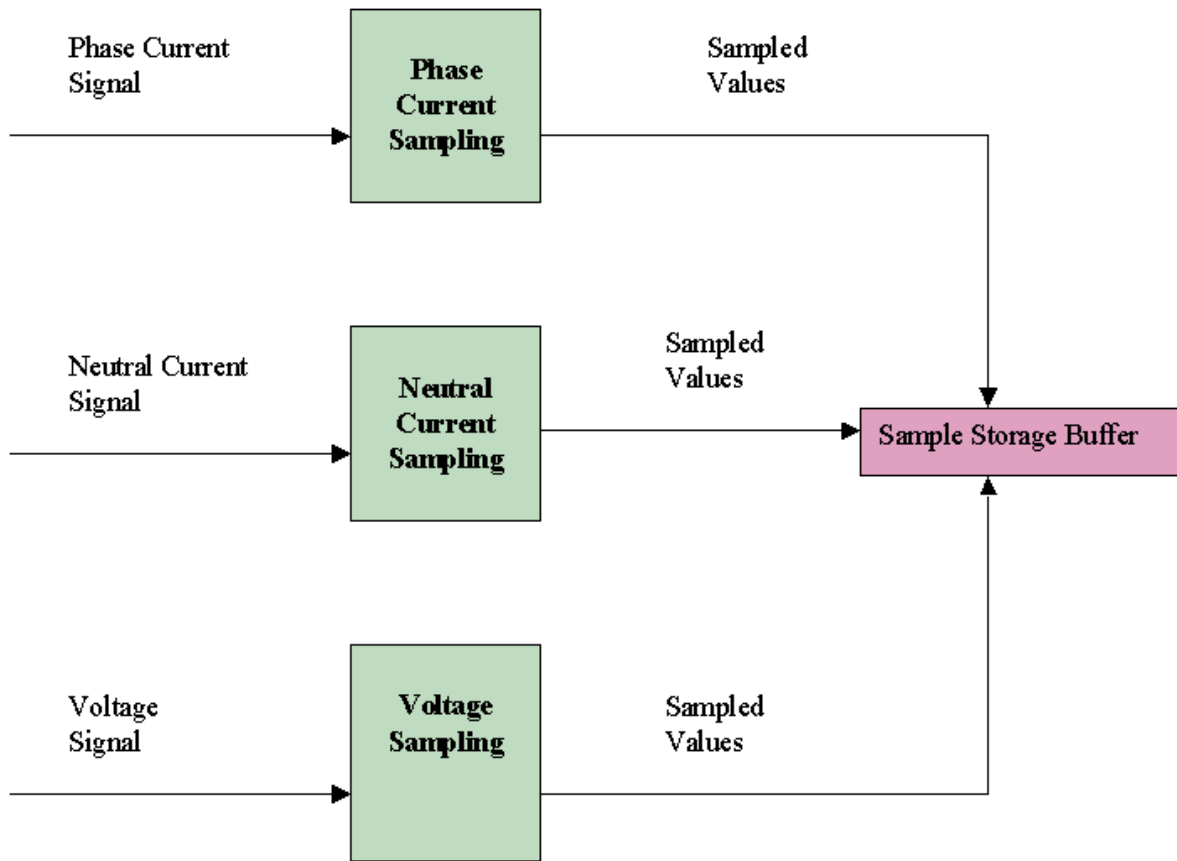
In Programming Mode the meter shall be able to program:

  - 1.Tariffs and Slots
  - 2.RTC (Leap year Correction)
  - 3.Scrolling period programming (three options shall be 10 sec, 20 sec or 30 sec).
  - 4.Intergartion Period for MD (two options shall be 30 min or 60 min).
  - 5.Unit code (Max 6 Characters) of Meter.

## 2.1 Main Process Flow:

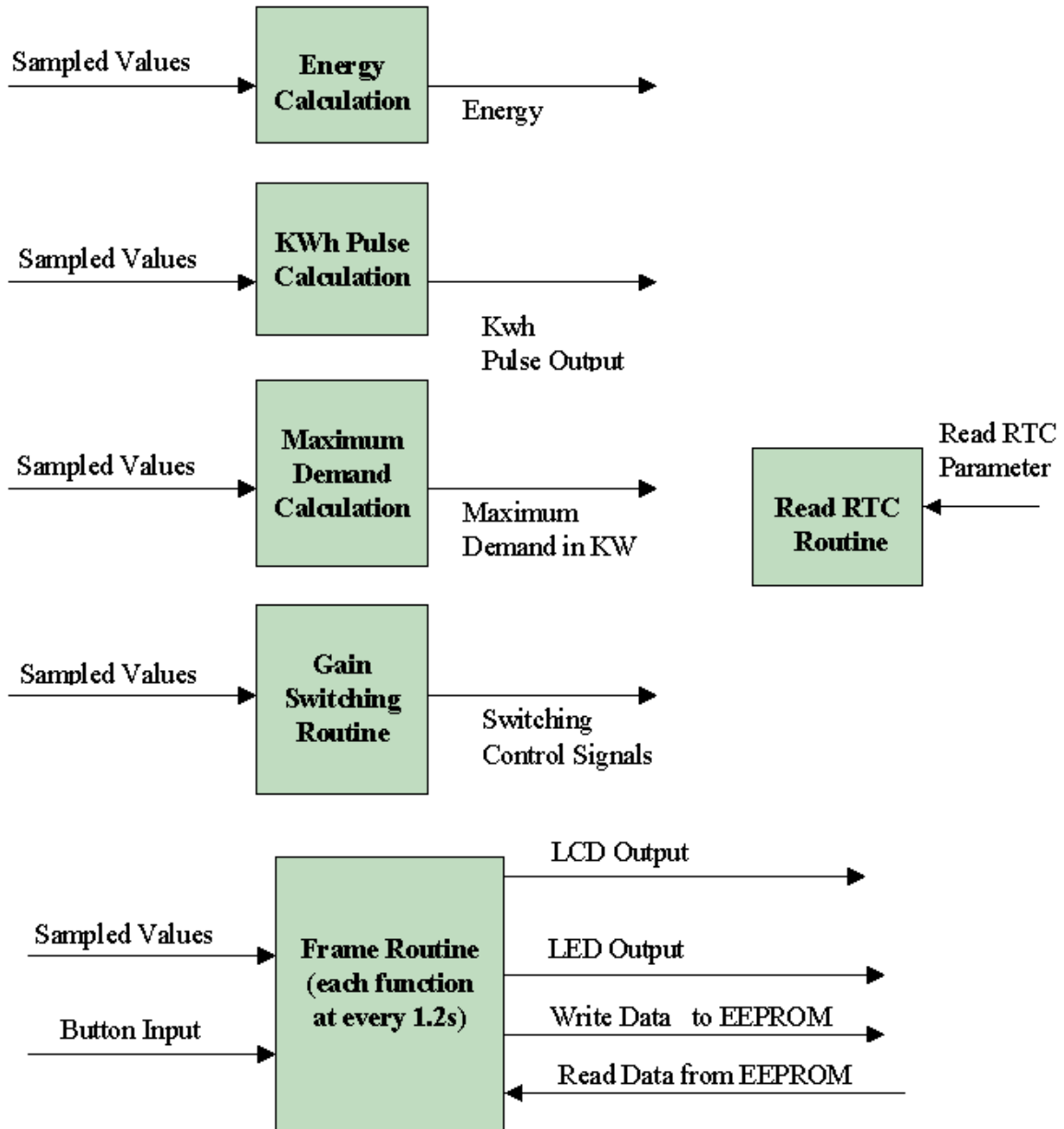


## 2.2 ADC Interrupt Service Routine:





### 2.3 Calculation Routine (at Every 120ms)



## 2.4 Frame Routine (each function at every 1.2s)

