# Caravan Battery Monitor Program - Notes

Current Version: 4.10  April 2023
File Name: cfe-34.bas and cbe-34.bas
Requires MMBasic V5.7 and Micromite 470 with RTC module and7" LCD panel as display back end and Micromite 170 with custom interface as front end data collector.
Current sensor system based on Allegro ACS758 modules.
- see details below.
(Note: A copy of the original "Notes" is attached as Annex A. that describes the original system.

**Sometime around 2013:**

Some years ago, a very good mate of mine introduced the concept "Creeping Elegance" - a term he used somewhat tongue in cheek and disparagingly to note engineer's habits of continually trying to "improve it a bit more!"!

This is a classic example:

I started as a caravanner wanting a good/better method of monitoring the status of the van batteries, the solar charging system and how long till "brownout" when free-camping.  What few commercial systems available, were several thousand dollars and almost impossible to retrofit to an existing older van without ditching everything and starting again - a major and cost prohibitive exercise.

Accordingly, in true engineering thinking, I said, "Self, I can do this with MM and some custom h/w circuitry", hence the CVBM project was born.

It is still a work in progress which I will potter away at for some time (probably due to the issues in paragraph 1 above or until senility takes over ;-).  With this current version, it is getting closer to a finished and usable product however, there is always room for improvement in functionality and coding "cleanliness".

**February 2017 Update:**

I have extensively re-designed the system (see para 1 :-) ) in several ways:-

1. Current sensors are now Hall effect modules - Allegro ACS758 units - in place in the high side (12V positive) circuits;

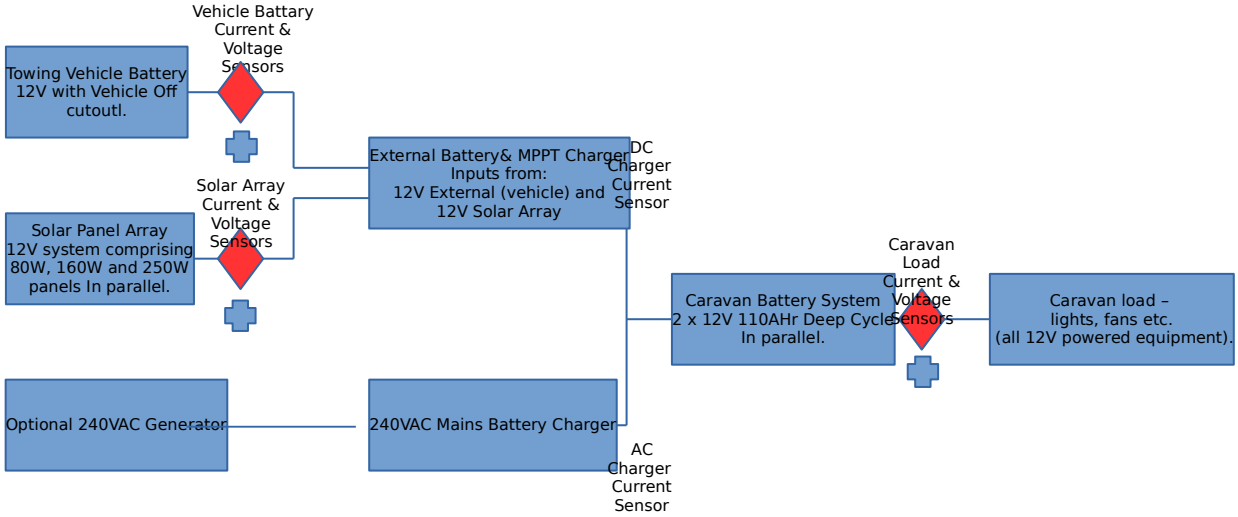
2. There are now two charging systems, a 240VAC mains battery charger model X25000 and a combo external DC (car) and Solar battery charger model D250S;

3. Current sensors now monitor all the charging and load current; and

4. Sensing is now carried out by a Micromite 170 "front end" in the battery bay which provides data values via RS-232(TTL) to a display module using a Micromite 470 driving a 7" LCD panel in the van interior.

5. Display unit now updated to use GUI controls and touch interface.

## Caravan/Vehicle System Block Diagram:



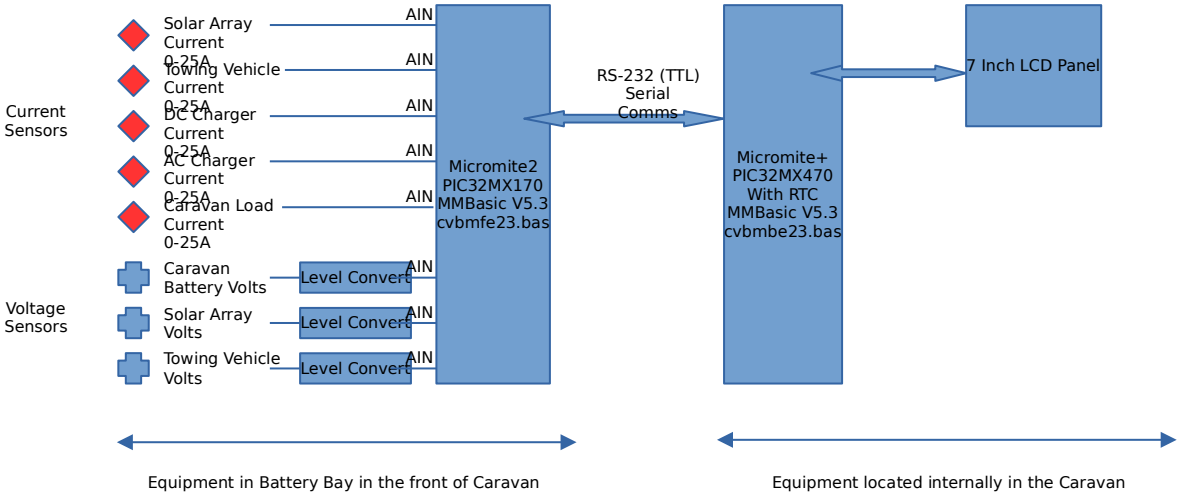

As can be seen in the diagram above, there are three sources of power into the system:-

1. Solar panels on the roof of the caravan provide 400W at a nominal 12V into the Ctek D250S Solar MPPT module;

2. Alternator supply from towing vehicle – nominally 13.8V when vehicle is running. There is an auto cutout in the vehicle such that when the ignition goes off, the supply to the caravan is cut off. The input from the towing vehicle also goes into the Ctek D250S intelligent charger; and

3. A smart 240VAC battery charger module Ctek X25000 to charge the batteries when in a caravan park or when running on generator.

## Caravan Battery Monitor System Block Diagram:




## Data collection "Front End"

There are individual ACS758 current sense modules on all positive (high side) charging lines: the towing vehicle into the D250S, solar panels into the D250S, D250S output and X25000 output. The outputs from both D250S and X25000 are summed to give Input Current (total charging/input current).

Lastly, there is an ACS758 current sense module on the load side, thus input current minus load current gives current either into (charging) or out of (discharging) of the battery.

The 5 current sense modules are configured such that at 0A current the output is exactly 2.5V which is sampled by the Micromite2 in the front battery bay of the caravan. The ACS758 modules give 40mV per ampere of current through them and although bipolar, are only used such that as current increases through them, the output goes from 2.5V at 0Amps to 0V at 50Amps.

The 3 voltage sense lines, vehicle battery, solar panels and caravan battery are passed through voltage dividers to give a nominal 2.5V for 15V input from the car and caravan batteries and 2.5V for 25V from the solar panels. This shows that 8 analogue inputs on the Micromite2 are required as sense inputs (5 for current and 3 for voltage).

Display Section "Back End"

The display system is a Micromite Plus driving a 7" LCD panel (referred to as the "Back End") and is located in the caravan internally. Every 2 seconds, the back end sends a data request character via serial com port to the Micromite2 in the battery bay (the "Front End") which responds by sampling all sense lines and transmitting the results back inside to the display unit.

The display unit shows 4 different lots of values;

1. Instantaneous values updated every 2 seconds;

2. Minute average values derived from summing the 2 second values and dividing by 30 at the minute rollover

3. A running summation in Watt Hours of input current, load current and battery charge/discharge current, and

4. A running graph of battery charge and minute average values over a 6 hour rolling window.

Software

The are 2 different software modules; cfe-34c-sim.bas for the Micromite2 in the battery bay in the front of the caravan and cbe-34c-live.bas for the Micromite Plus inside the caravan.

The Micromite2 front end is a custom design I created and uses a PIC32MX170 board running MMBasic 5.4.

The front end program is a simple loop waiting for a signal character (ASCII 'R') to arrive from the back end requesting a sample of all values. The sampling is done and transmitted to the back end. Data integrity is a simple appendage of "zz.zz" to the end of the sampled data stream that is checked for by the receiving back end program.

The Micromite Plus back end is a Peter Mather designed circuit board purchased from Circuit Gizmos and assembled by me. It has a small DC to DC buck converter deriving power from the caravan battery and converting down to 8V to provide a stable voltage into the Micromite Plus. The display is a 7" LCD Panel using the SSD1963 controller. The Micromite Plus is running version 5.4 of Geoff Graham's MMBasic.

The back end program is somewhat more complex. All display and user interface operations are carried out by GUI statements. The main program loop just cycles waiting for a timer interrupt (to generate a "data request" via a COM port to the front end) or a "data received" interrupt from the COM port signalling data in from the front end or a touch interrupt from the SSD1963 7" display signifying a user touch request.

As well as receiving instantaneous readings from the front end, the back end "averages" the values over 60 seconds and stores these values in arrays for later historical display. These are "running" averages continuously updated.

Still to do!

Extend user interface to include options for data logging;
Audibly flag low battery or charge source failures;

Sample Back End User Interface Displays