

## Getting Started

- Firstly you must load webmite software to suit your PICO -w or PICO2-W. The download is here: <https://geoffg.net/webmite.html>
- Download: PicoMite firmware V6.02.00
- This download includes a number of files. The firmware you want is either the WebmiteRP2040V6.02.00.uf2 for the PICO-w  
Or  
WebmiteRP2350V6.02.00.uf2 for the PICO2-w
- Although not essential, I recommend reading the Webmite manual from the download.
- Hold down the white button on the PICO and then plug it into a USB connection on your Windows computer. Release the white button. You will now have a drive showing in Windows Explorer. Copy the needed .uf2 file from your computer into the RPi drive. It will automatically install your operating system (webmite MMBASIC).
- Unplug the USB and replug it. The RPi drive disappears and the PICO now appears as a ComPort. Run Tera Term and locate the new Comport and connect to it.
- Type <ctrl>C and you should be welcomed with a ">" (the command prompt). Type *print 2\*3* and it will respond with a 6. You are now in control.
- Do the following commands:

### Option wifi "ssid","password"

ssid = your router's SSID (it might look like this "Telstraxyz123") and the wifi password. The quotes are needed.

The pico will report your LAN IP address e.g. 192.168.0.XY

Write the IP address down.

### Option tcp server port 80

### Option telnet console on

You now have a functioning web server and telnet access. Unplug the PICO-W as you'll now work using the IP address through the network. You could ping the pico-w from the computer or your phone if you want to check it out.

## Loading the BASIC program and Index.html

- Set up an administration CMD prompt on your computer. Navigate to your correct directory via the command prompt. E.g. in my case type *D <enter>* for my D: drive, then *cd\rpi pico-w <enter>* for the directory of my PICO files.

- You may have to activate TFTP on your computer.  
Open the **Control Panel**, select **Programs and Features**, click **Turn Windows features on or off**, check **TFTP Client**, and click OK.
- Type: `tftp -i 192.168.0.XY put vk5djbat.bas<enter>` at the command prompt.  
Note: use your correct IP for the PICO and no quotes used.
- Run Tera Term. Connect to the PICO using Telnet (enter the IP address first)
- Type `run "vk5djbat.bas"` (the quotes are essential)

Note that loading the program is only putting it into the "A" drive of the PICO. It needs to be RUN after every change you might make to an uploaded BASIC file. The command RUN copies a tokenised version of the program from the internal drive into RAM and then runs it. This strategy speeds up the operation for this interpreted system.

Once the program has been run once, if power is lost the program will autostart.

Two other files are created as 24 hours go by i.e. "Settings.dat" and "Solar.dat".

The first records the values at 6AM, 9AM, Noon, 3PM, 6PM and 9PM providing a history over the last 24 hours. The second file records the solar data, one value is today's incremented reading and the other is the total for yesterday (updated at 1AM).

## The 16F1827

The PIC provides backup services separate from the PICO. It is extremely reliable.

- If the PICO should drop back to the command prompt it detects this and performs a reset of the PIC within a minute.
- Once a day it saves all the essential variables and then does a reset of the PICO. This is performed 24 hours after power was first applied. The process takes about a minute before coming back on line. There are also strategies within the PICO to check for any failures e.g. once an hour it checks with the NTP time server. As well as ensuring the time is accurate in the program if for any reason the server locks up it will do a reset. The PICO and the PIC have watchdog timers set. The reason for the complexity is that there have been occasional known problems with the PICO server failing after a few days. In view of the fact that the system is located at a remote site it will always recover from a problem – worst case in 24 hours and prevents a trip up the hill.
- The system will run without the PIC in place but better to have the extra security. The PIC can be either a PIC16F1827 or a PIC16LF1827 as the main supply is 3V3. When programming the PIC, I recommend powering the board from a power supply rather than through the programmer, otherwise the programmer could feed 5V onto the 3V3 bus.
- The program for the PIC is "batterytime.hex" and is included in the software and manual package. I use a PICKit3 or PICKit4 and Microlab software.

## Setting the calibration register

- Now would be a good time to run “batteryVK5RMG.exe”. Use the Help button for further instructions. You will need to enter the shunt resistor value, the default is 0.0025 ohms for a 30A system or 0.01 ohms for an 8V system). Most shunts are labelled. You won’t be able to measure the shunts with most ohm meters they are too small in value. If your shunt is not labelled you could pass say 5A through the shunt and measure the voltage in mV across the shunt then put the values into the Windows program top right.
- Once you have the shunt value put it into the Windows program top left, adjust your I2C address if necessary (most default to &H40) and click the button. The program calculates the I<sup>2</sup>C string for the calibration register of the load. Copy it if it is different from the string already at line 207 in the “vk5djb主.bas” file.
- Repeat the above for the solar calibration after changing the I2C address to say &H41. You’ll need to jumper an A0 solder tag on the board. You’ll need to paste the calibration register into line 212.

## Setting the configuration register

- This time use the Determine Configuration Register section of the Windows program.
- It’s unlikely you’ll need to change this register, but just in case you have some choices.
- The defaults are 16,1100,1100,shunt and bus continuous.
- This creates a configuration register of :  
I2C WRITE &H40,&H00,&H03,&H05,&H45,&H27 which you will find at lines 206 and 211 of the PICO program *vk5djb主.bas*. I use Notepad++ for working on *vk5djb主.bas*. The line numbers refer to those produced by Notepad++
- The provided file assumes a shunt resistor of 0.0025 ohms for a 32.768A FS

## How the INA226 (INA219) responds - rules

- In order for the device to respond accurately it must **first** receive a configuration register, essentially to set the general conditions. Look up the data sheet if you need more explanation.
- Next, *vk5djb主.bas* must set the calibration register for current to be read. The calibration register provides a value that is used as a multiplier to the value read from the current register to get the actual value for current.  
$$\text{Amps} = (\text{value in register } \&H04) * (\text{calibration value})$$
$$\text{Voltage is read from } (\text{value in register } \&H02) * (0.00125).$$
- A small quirk of talking to the INA board is that before reading current or voltage the board must first be told which register you are about to write.

- I2C WRITE &H40,&H00,&H01,&H02   'tell the INA226 to read from register \$H02  
I2C Read &H40,&H00,&H02,dta%()   'read two bytes of volts from register &H02
- A quirk of MMBASIC is that it does not have a byte variable type so a read of two bytes is best performed by reading two bytes into a two integer array.

## Calibration fine tuning

This may be done using the lower two panels of the Windows program.

The voltage reading may be adjusted using the voltage correction section of the Windows program. Enter the existing multiplier from line 323 or 347. Measure the voltage at the output end of the INA sensor and note the output value on the phone display. Add the values to the Voltage Correction panel. Clicking **fix volts** will provide the new multiplier. The multiplier may be different for the load and solar INA226s so you'll need to do it twice.

The current fine adjustment is done in a similar matter in the lower left panel. Firstly do the original calibration in the top panel as per your original adjustment. This sets the reference for use in the panel below, then enter the displayed current in your browser (e.g. it might 11.2A) and the meter measurement from your power supply or a multimeter in series with the load (e.g it might 11.3A) click fix amps. The new calibration string is ready to be pasted into vk5djbat.bas at line 207 or 212.

You'll probably need to do this for both load and solar INA226/INE219

## Temperature and Humidity

The program works with either the DHT11 or DHT22. The latter is considered the best choice. *vk5djbat.bas* will require a change if you use a DHT11 in line 375 in Notepad++.

The default at the end of line 375 is a 0 for DHT22 and 1 for a DHT11. The pin outs for the two sensors are different and available on the web.

The sensor is checked every two seconds.

The device is now set up

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VK5DJ

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