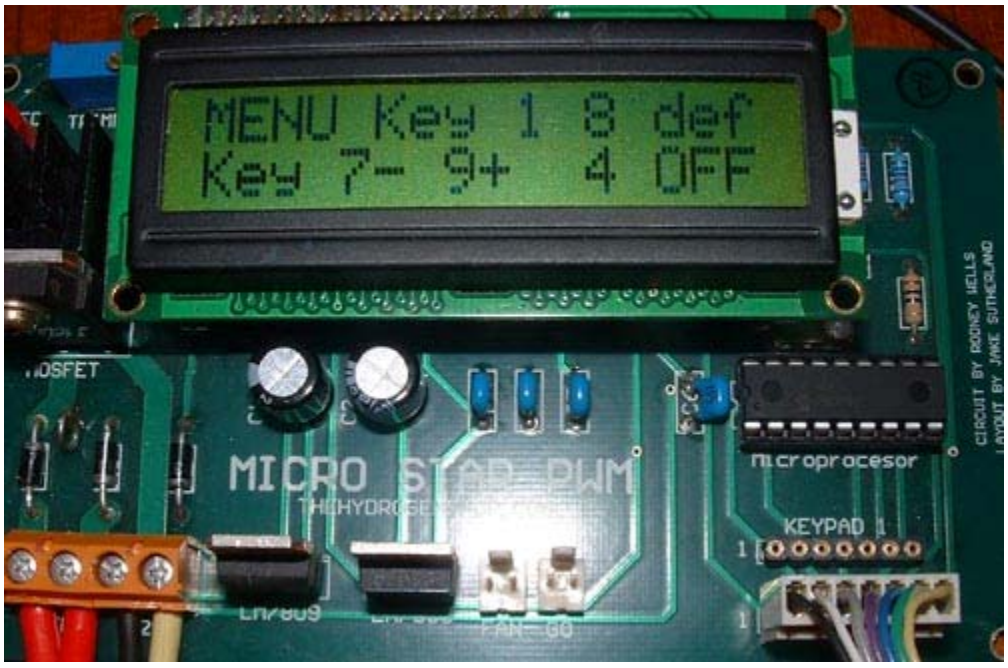
Micro Star User Instruction Guide
Version 2.605

You have probably just completed the construction phase of the microprocessor-controlled PWM. This unit has been developed to assist those users interested in the pursuit of electronic control of the water fuel cell (WFC). The intention is that this unit provides a diverse range of frequency control.

The unit comes pre-programmed with a set of data parameters to generate a frequency at "power up" of 42.72 KHz at a 50% duty cycle.

IMPORTANT: If you have constructed the Micro Star yourself you have probably noticed that the display on the LCD has illuminated but that no writing has appeared. This is because you now need to adjust the 25 turn trimmer pot, just behind the heat sink, to illuminate the contrast of the display.

Main Menu Display



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After power-up and the data sequences have been loaded, the display will appear as in the photo above. The word “Menu” in the top left-hand corner of the display signifies you are in the main menu position.
By pressing Key 1 it is possible to cycle through the other user function menus until you return to the main menu, completing one cycle of all user functions.
Referring back to the main display, in the top right-hand corner of the display there is the reference “8 def”. This abbreviation refers to loading factory defaults, i.e. pressing Key8, whilst only in the main menu, will load the factory defaults. This function was introduced so users could return the Micro Star to the standard settings.
In the bottom left-hand corner there is a reference to key function 7 and 9. These two key functions are used through all other menu functions to add or subtract values to settings.
In the bottom right-hand corner there is a reference “4 OFF”. This signifies whether or not the Micro Star is generating a PWM signal on its output. Whenever the Micro Star is powered down it will reappear in the “OFF” position. By toggling Key 4, the PWM can be switched on and off. This is only possible in the main menu position.

Main User Key Function

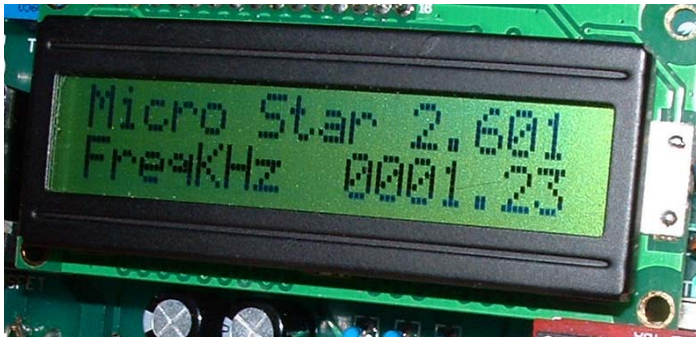
- Key 1 is “Menu Access”. The menu system of the Micro Star can be accessed by repeatedly pressing key 1. The user will see all the available options cycle through as ‘1’ is pressed.
- Key 2 generates a pulse width modulated signal of pulses varying from 2 to 80 pulses as defined by the user. The μ sec delay can also be varied as defined by the user. These parameters are controlled in the menu function labeled “MKs”, i.e. Mark Space settings.
- Key 3 returns the user to the standard pulse width modulated signal.
- Key 4 has 2 uses in different menus. As mentioned above, Key 4 can switch the PWM on and off in the main menu. In the frequency range menu it is used to set the frequency range (resolution at that range) of 1.23 KHz.
- Key 5 is for use within the frequency range menu only. It sets the frequency range to 4.89 KHz.
- Key 6 is for use within the frequency range menu only. t sets the frequency range to 19.53 KHz.
- Key 8 is for use within the frequency range menu only. It sets the frequency range to 78.12 KHz.
- Key 7 is for decreasing the amplitude of options within the menu system.
- Key 9 is for increasing the amplitude of options within the menu system.
- Key 0 is for testing the micro switch function which may or may not be present, depending on the version of the Micro Star you have purchased.
- # Key deactivates the keyboard so that no key functions are possible and is a safety lockout. It also has the added bonus of reducing the processor’s house-keeping requirements by eliminating keyboard scanning, which uses up precious clock cycles.
- * Key reactivates the keyboard but it does so by causing an internal interrupt and does not use any clock cycles to do so.

Menu Function and Display

On power-up “Micro Star” and ROM version will be displayed.

After a 2 second period the screen will blink and a new set of parameters will appear as the processor goes through the “boot” sequence.
Loading data will appear on the display and you will observe the data parameters loading one at a time in quick succession. You will also observe the frequency change as the computer completes the boot sequence.

Following another blink the screen will move into “Menu” mode.



At this point the user can access all program functions by cycling through the menu options using key 1.
Keys 7 and 9 are also displayed and are the prime user keys with all other menu functions.

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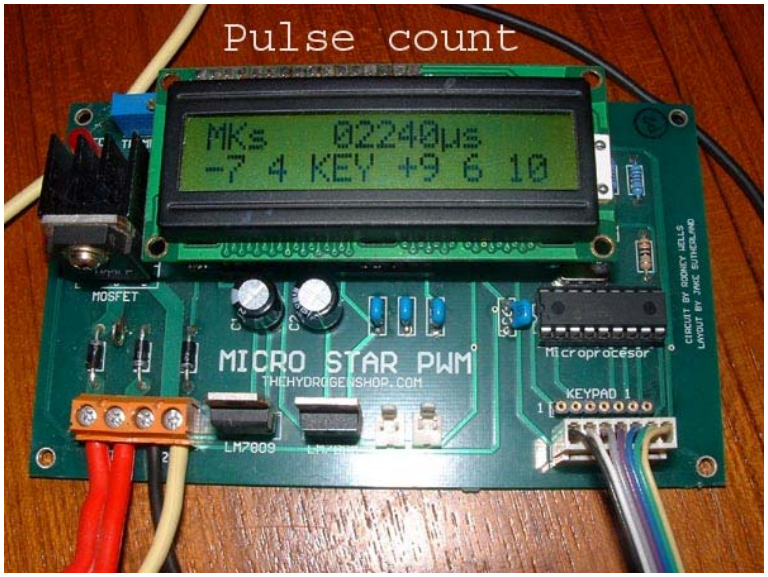
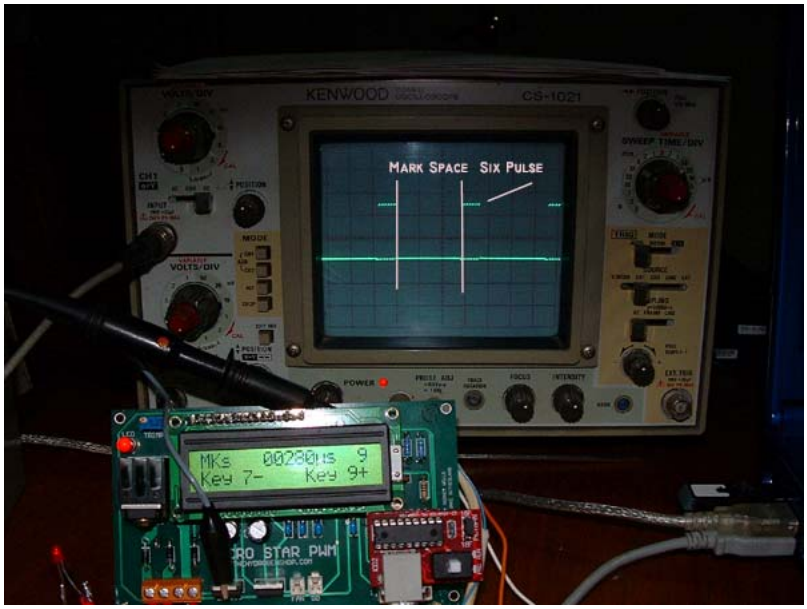
First Menu Option:- *Mark Space Mode*.



Pressing Key 1, the first option to appear in sequence is your mark spacing control. Mark Space Mode has been developed as an advanced user option. Its primary application is for those users wishing to experiment with the voltage intensifier circuit. This option is only relevant when in VIC circuit mode, which can be accessed via Key 2.



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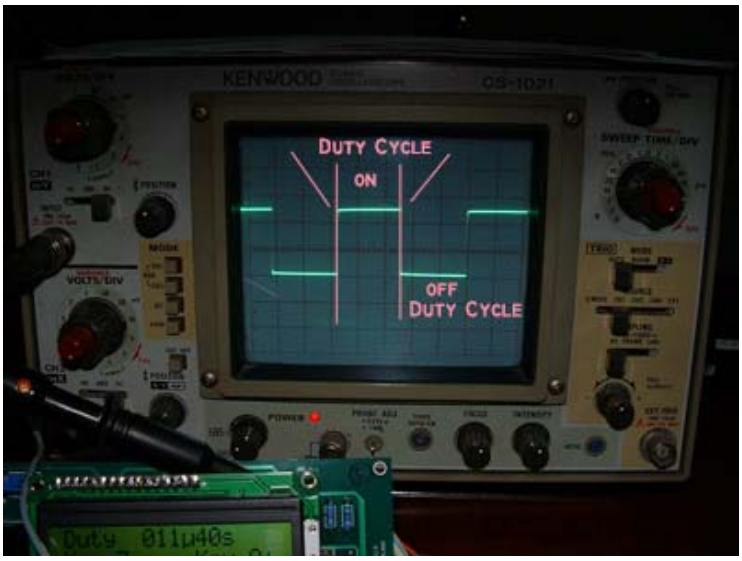
The mark space time delay is displayed in micro seconds (μ sec) and accumulates at 140 μ sec intervals by pressing Key 9.
Key 4 and Key 6 are also displayed on the screen above. Key 4 is used to decrease the number of pulses per mark space while Key 6 is used to increase the number of pulses per mark space. This is the value that you will see change in the bottom right-hand corner of your LCD display.
Please note: Pulses will change in increments of 2.
Also note that the data save function, "Key 8" can be used and all settings saved. "Saved" will appear on the LCD display once the saving process has been completed.
It is also important to note that all data parameters can be saved into memory in any menu location except the frequency range.

The user can switch between VIC circuit mode and Micro Star mode from anywhere within the menu at any time.

Second Menu Option:- *Duty Cycle Control.*

Pressing Key 1 again, the second option to appear in sequence is the duty cycle control. The duty cycle is a ratio of the "on time" and "off time" of the overall frequency range being generated by the PWM and is measured in micro seconds (μ sec). The "on time" is reversely proportional to the "off time" of the frequency so that adjusting the "on time" automatically changes the "off time", e.g. 80% "on pulse" provides 20% "off pulse". The data presented on the LCD display is a measurement of your "on cycle".
Key 8 saves all data and will appear on the display.



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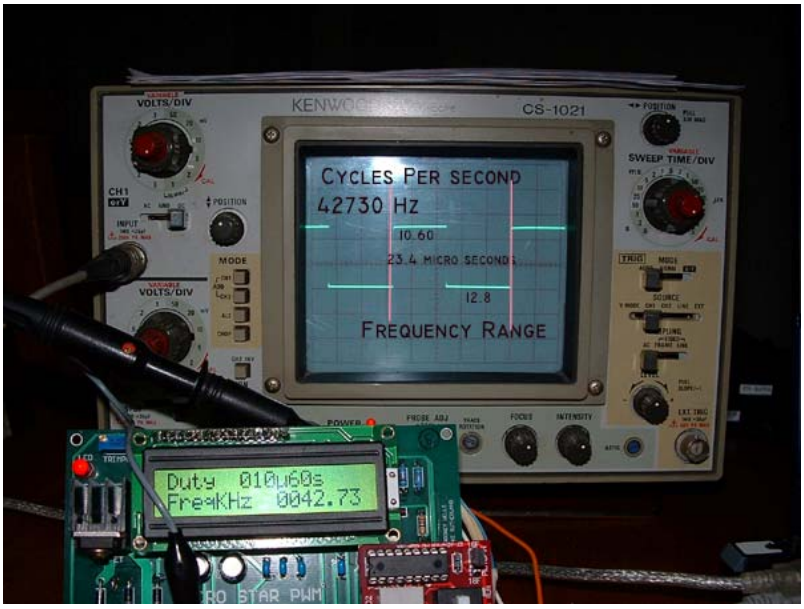
Third Menu Option:- *Frequency Adjustment.*

Pressing Key 1 a third time, the next option to appear is the frequency adjustment and is displayed on the LCD in KHz. This is a measurement of cycles per second, e.g. 42.73 KHz is 42,730 cycles per second. While in this mode, pressing Key 7 or Key 9 increases or decreases the frequency range respectively.

$$\text{Time in seconds} = \frac{1}{42730 \text{ Hertz}} = 23.402 \text{ μsec.}$$



In this menu option the user can see both the duty cycle and the frequency data displayed.
Key 8 saves all data and will appear on the display.

Fourth Menu Option:- *Frequency Range Selection*

Pressing key 1 four times provides the frequency range selection. In this mode, there are four frequency range resolution options:

1. Pressing Key 4 while in the frequency range option will give you a resolution range at 1.23 KHz;
2. Pressing Key 5 will give you a resolution range at 4.89 KHz;
3. Pressing Key 6 will give you a resolution range at 19.53 KHz; and
4. Pressing Key 8 will take you to 78.12 KHz.

It is required that the user selects a frequency closest to the user's desired frequency and then adjusts the frequency further in the previously mentioned Frequency Adjustment Menu Option till they reach their optimum frequency.

Note: At any selected frequency range the frequency can only be increased and cannot be reduced.

Fifth Menu Option:- *Data Save Mode*

Pressing Key 1 five times takes you into the data save mode. Once you have set your PWM frequency, duty cycle and marked spacing and decided what user mode you are in, this configuration can be saved in this menu option into the microprocessor's flash memory simply by pressing Key 8. Once you have done so the word "saved" will appear on the display.
Any changes you make after this will not affect data saved. This information is also retained when the circuit is powered down.

Sixth Menu Option:- *Loading Saved Data*

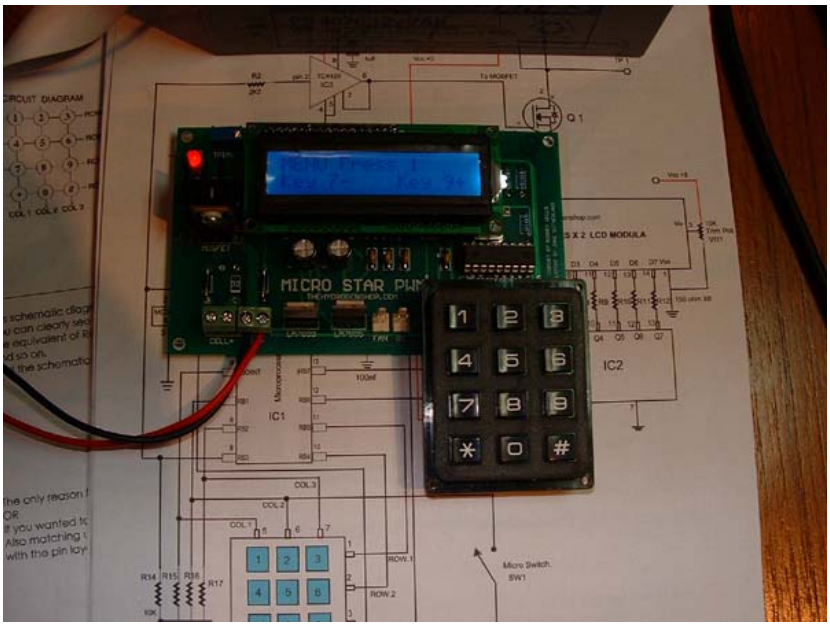
Pressing Key 1 six times takes you into the mode for loading saved data. When in this mode you can reload previously saved data back into the processor's configuration by pressing Key 8 which is displayed on the screen. This is a useful function because if you have saved a successful set of frequency parameters, then decide to tweak this frequency and things don't work out, you can go back and load your preferred data settings and start again.

Seventh Menu Option:- *Throttle Control*

This is the name I have given to the seventh press of Key 1. The use of this function is about a preset condition that can be activated at the press of key 0 on the keypad, or it can be wired to a simple micro-switch, labeled on the PCB as the GO pin.
By connecting a small toggle switch or micro-switch to the GO input pins you can control the duty cycle to a predetermined position. Key 8 saves all data and will appear on the display.
The application that comes to mind would be attachment to the accelerator pedal for throttle control. Adjustment to the preset condition is made by using Key 7 and Key 9 as in the previous adjustment options.

By holding down the 0 Key the adjustment of the preset option can be viewed in the duty cycle measurement display area. You will notice it will blink backwards and forwards between the adjusted value and its original value. This value is only viewable from this menu position.
When satisfied with the value set, the data can be saved by a press of Key 8.

Another press of Key 1 completes the cycle through the menu.



I welcome feedback from users concerning any upgrades that they consider would be helpful to the development of this micro-computer system. The microprocessor can be pulled from the main circuit and posted back to me for version upgrades or custom modifications as required.

Contact: www.thehydrogenshop.com
hydrogenshop@optusnet.com.au

Key Pad Explained

In the bottom right corner of the PCB under the Microprocessor, you'll notice 2 lots of output pins for Keypads.
This is because during the design process, we found there were many different types of Keypads available and depending on what can be supplied, or what you, the consumer prefer, determines what type of output arrangement required. If you do not understand, read on.

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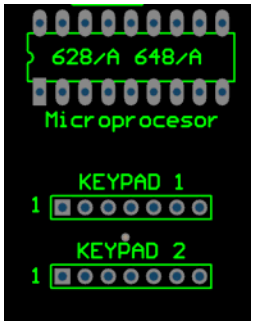
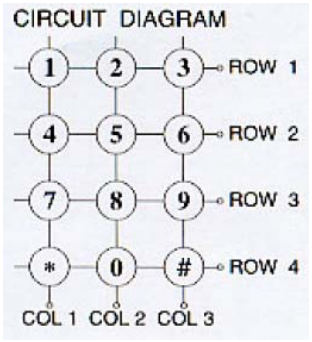
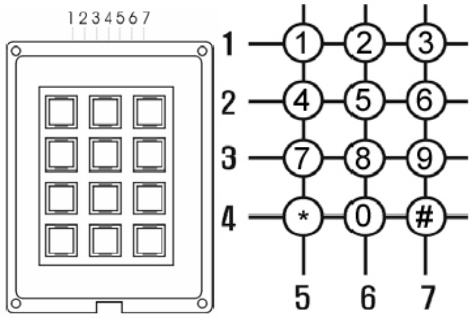
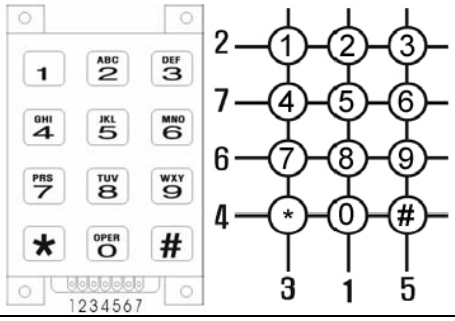


Some keypads are better for surface mounting, some are better for durability.
So we designed the PCB to allow for 2 types of keypads.
These are the 2 types.
If you have requested to purchase your own components, these are the only compatible keypads.
You must find a keypad with either of the 2 OUTPUT PIN LAYOUT!

		Output Pins	Row/Column
	**KEYPAD 1** 	1	Row 1
		2	Row 2
		3	Row 3
		4	Row 4
		5	Col 1
		6	Col 2
		7	Col 3
	KEYPAD 2 	1	Col 2
		2	Row 1
		3	Col 1
		4	Row 4
		5	Col 3
		6	Row 3
		7	Row 2

This schematic diagram shows how the keypad output pins are connected on the PCB. You can clearly see above,
Keypad 1's first output pin = Row 1.
The equivalent of Row 1 on Keypad 2 = Second output pin.
And so on. And the schematic proves this.

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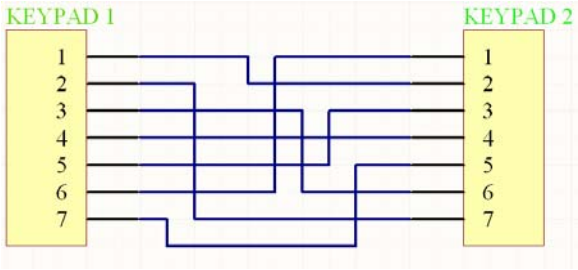

The only reason for this is so that certain types of keypad's can be mounted directly to the PCB or
If you wanted to mount everything in an enclosure, ribbon cable can be used and not have to twist and turn.
Also matching up pins on the keypad with the PCB is easy simply because the pin layout on the PCB is in order with the pin layout on the keypad.

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