Basic 4 Channel Generator Operation

The 4 Channel Generator has 1 power input, 4 frequency outputs, 4 basic controls, and a 5 line OLED (Optical Light Emitting Diode) display. The Generator also comes Wi-Fi ready. At this time the Wi-Fi feature will only start and stop the Generator remotely. All the source code is provided on the Generator's SD Ram card along with everything needed in the way of documentation to duplicate this Generator. It is hoped that hobby or programming enthusiast will come on board with added Wi-Fi features down the road. The 4 Channel Generator project is completely OPEN Source.

The Generator can be powered by a wide range of DC voltage sources. A 12 volt power supply or lithium battery works best. However it will work with any DC voltage supply ranging from 5 to 12 volts. There are 4 internal and selectable jumpers that will select either 5 volts or the supply voltage level as the voltage output level for each of the 4 channels. Hence with a 12 volt supply, the user can select either a 5 volt or 12 volt output for each channel.

There are two push button and a rotary encoder that also has a push button feature. These controls are used to make the Generator do its magic. The Red and Black or Blue push buttons are multifunctional buttons. The rotary knob press button feature will only do a system reset.

RED Button:

When the OLED display shows 'Setup=0" the RED button acts as the unit's Start/Stop button. When "Setup=" equals a 1, 2, 3, 4, or 5 it will initiate a program update feature when pressed. When pressed the OLED will display "Update" and store any presently loaded program changes that were manually dialed, --- into the MPU memory. This will not Update the SD Ram card. To update the SD Ram, the Black button must first be pressed and held down and then the Red button must be momentarily pressed. The OLED will display "Update the SD Card ??". If the Black button is released nothing will be stored. If the Black button is still held down for 3 seconds then the OLED will display "SDRam Card UPDATING". Yes, you are given plenty of time to really commit to storing to the SD Card. It is a nice safety feature.

Black Button:

The **BLACK** button is used to step the cursor through the various OLED display screen numbers. For those familiar with the "Telligent" it works in an identical manner. Basically whatever number the cursor steps to, that number can be changed by dialing in a new number with the Rotary Encoder. The BLACK button also has a secondary function which is to Pause and Un-pause a program while it is running. When pressed during a program run the OLED will display "Suspend" at the top of the screen. The OLED will also show where the program is at by displaying relevant run time numbers on the screen. Pressing the button a second time will resume running the program.

PROTOCOLS:

There are many ways to build a Protocol or to Set Frequencies list with the 4 Channel Generator. Probably the easiest is to remove the SD Ram Card and edit the 'Protocols-0' through 'Protocols-9' with a computer word processor. Using any of the Protocols-x files as an example template is a way to easily gain protocol familiarization. There is a PDF document below, "Generator Micro SDRam FILES and FORMAT" that goes into a detail description of the file format and it suggested you review this document thoroughly.

SCREENS:

There are 6 display screens and they are labeled "Setup=0" through "Setup=5". By rotating the encoder dial you can step through these screens one at a time. The word "Setup=0" is displayed in the top left corner of the OLED. Turning the encoder knob will rotate through each screen. The "Setup=3" screen is dependent on "Mode=2" being active. "Mode=2" is called the PROTOCOL mode and more info on this further down in this document. The "Setup=4" screen is dependent on "Mode=3" being active. "Mode=3" is called the SWEEP mode and more info on this further down is this document. The "Setup=5" screen is the timing and program file selection screen. It is suggested you review these screens along with this information by actually dialing to the screen with a Generator in hand.

Setup=0 Screen:

This screen is the program running screen. You must be in this screen to Start/Stop the 4 Channel Generator. Pressing the RED button as stated above will Start/Stop the Generator. This screen displays the selected protocol line of frequencies from the MPU Program Memory. All numbered program lines in memory will contain the frequency and duty cycle for each of the Generator's 4 channels. They will be displayed on this screen in accordance with the "Freq Rds=x" parameter that is displayed to right of the "Setup=0" function. By using the cursor step button, the BLACK button, you can step to this function and dial in all the program lines in the program memory. Pressing the cursor step button again will snap you back to the "Setup=0" function again. The "Setup=0" screen will only let you read the program memory. Program memory cannot be changed while in this screen.

NOTE: Program memory is always loaded from Protocol File 0, also called the "protocols-0.txt" file when the Generator is turned on or the reset button is pressed.

Setup=1 Screen:

This screen will allow you to actually change a line in the program memory in accordance with what is displayed in the "Freq Rds=x" function. This screen looks a lot like the "Setup=0" screen but there is a big difference when you press the cursor BLACK step button. The cursor will step through all the changeable values displayed on this screen. By stepping to a number and then rotating the encoder knob, the display number above the cursor will change. By holding down the BLACK button, the cursor will fast step through the whole screen. In other words every numeric number displayed can be optionally changed on this screen. To actually record all the screen changes that may have been made,

you must press the RED button to perform the, "Update", program memory update function. This is how you can rewrite a program to anything you want to do.

NOTE: Only program memory is updated. It is not stored to the SD Ram unless you followed the storing process described in the beginning of this document.

Setup=2 the Mode selection Screen:

This Screen will select which mode of operation the Generator will run. It also shows what version number of the software the Generator is running under. There are three modes of operation and they are 1=SIMPLE, 2=PROTOCOL, and 3=SWEEP modes. At this point it would be appropriate to define the modes of operation.

Generator Mode 1 = SIMPLE:

This mode of operation is very basic. Whatever program line is displayed in the "Freq Rds=x" function on the "Setup=0" screen will be executed. If for example if "Freq Rds=5" then program line 5 will be read from memory and executed when the RED button is pressed. The 4 Generator outputs will run the 4 frequencies and duty cycles from this program line. It can't get much more simple than this!

Generator Mode 2 = PROTOCOL:

This mode of operation will consecutively run the range of program lines define in the "Setup=3" screen. Remember this when the OLED display screen descriptions are continued. If the generator is not in Mode=2 then the "Setup=3" screen will be blank. Otherwise it will display the parameters needed to run a protocol.

Generator MODE 3 = SWEEP:

This mode of operation will perform a sweep of the frequencies defined for channel 1 on the "Setup=4" screen. A sweep is only performed on Channel's 1 frequencies. The other channels will simple run what is displayed for the respective program lines they came from. If the generator is not in Mode=3 then the "Setup=4" screen will be blank. Otherwise it will display the parameters needed to run a sweep. The Sweep Mode is the most complicated mode and will be further defined in the "Setup=4" screen description.

Setup=3 the PROTOCOL parameter screen:

A Protocol is a frequency list consisting of more than one frequency. It can be 2, 3, or up to 275 consecutive frequencies the Generator needs to run to complete a protocol. This is where the real power of the Generator comes into play. Because the program lines are so easily constructed on the SD Ram Card, extremely sophisticated protocols can be composed for 1 or all 4 of the Generator outputs. Depending on the protocol requirements the Generator can run multiple devices all at once. It could run up to 2, 3, or 4 Plasma Balls, or a mix of devices such as a TENS unit, Plasma Ball, and Sonic delivery

device. It could run a Pulser, LED display, Infrared display and still have an output available for another device.

The parameters needed for a protocol are "Range Starting" and "Range Stopping". The "Range Starting" is simply the memory program line that has the starting 4 frequencies and duty cycles to start the protocol with. This line number is the same number used in the "Freq Rds=x" parameter when displaying "Setup=0" or the "Setup=1" screens. The "Range Stopping" is simply a memory program line that has the ending frequencies and duty cycles of the protocol.

For example: If "Range Starting = 4", and "Range Stopping = 6", the Generator will read program line memory position 4, execute the frequency request and then move to program line memory position 5 and execute the frequency request and finally move to program line memory position 6 and run those final 4 frequencies and duty cycles. The range is always defined by just two program line numbers. The range can be anything from 1 to 275 program memory lines. Remember, each program memory line has the frequency and duty cycle for all four generator channels. See the "Generator Micro SDRam FILES and FORMAT" for how easy it is to define frequencies and duty cycle program lines.

Setup=4 the SWEEP parameter screen:

This screen has three parameters that need to be provided. It has a "Range Starting = x" and a "Range Stopping = x" and a frequency increment parameter labeled "Freq. Inc. = xxxx.xx": The Sweep function only works with Channel 1 and the other 3 Channels are basically run as Simple Mode frequencies and duty cycles. The sweep function uses the two timer values from the "Setup=5" screen if and only if the Freq. Inc = 0000.00. In other words the Generator can automatically calculate the best frequency sweep values to perform a sweep between any two frequencies provided for Channel 1. This is a nice feature if you do not want to define a frequency increment value. The following example is a bit wordy, but it does define how the automatic frequency sweep works.

For example: Let's use the same line numbers as in the Setup=3 screen example. They are "Range Starting = 4" and "Range Stopping = 6". Program line 4's Channel 1 frequency value is recorded and saved for a little math processing. Program line 6's Channel 1 frequency value is recorded and subtracted from the recorded line 4's Channel 1 frequency value. The results is the frequency spread between the two floating point numbers. Let's just for example sake say the spread calculated to 100 hertz to make thing easy to understand. Now the Generator needs to calculate how many steps to do in the sweep function. The number of steps are determined by the two timer values that are entered in the "Setup=5" screen. The Generator has a frequency runtime timer and a program runtime timer. Again to make the numbers easy to understand let's say the frequency runtime timer is set for 1 second. Let's say the program runtime timer is set for 10 seconds. The number of frequency sweep steps is simply calculated by dividing program time by frequency time. In this example 10 divided by 1 calculates out to 10 frequency sweep steps. If the Frequency Spread is 100 hertz and there are 10 steps in the program frequency sweep, then there will be a 10 hertz increment for each frequency step. Wow! I hope you followed all that. If you didn't there will be a Video just on the Generators frequency sweep ability to clear things up.

Having a value other than zero for the "Freq. Inc = xxxx.xx" parameter is a lot easier to understand. It simply increments between two Channel 1 defined frequencies by a fix number of hertz. A sweep starts with the frequency derived from the Range Starting line and increments each frequency step by the fix Freq. Inc. value. It increments until it reaches the frequency derived from the Range Stopping frequency. Again there will be a video on this technique of frequency sweeping as well.

There is a lot more that can be said about frequency sweeps but this is supposed to be a Basic write-up on the Generator and there will be more in depth PDF articles as time progresses.

Setup=5 the timer and program load screen.

The last screen is the timer screen. This screen is almost self explanatory. Frequency time is defined in seconds and can be ranged to 9999 seconds. That is almost 10000 seconds which is over 166 minutes. That should be more than long enough for a frequency run time. Program run time is defined in minutes which means a program can have run for over 166 hours. A few things to note is that if all the program frequencies have been run and there is program time left, the program frequencies will simply be run again and again until the program time runs out. If the frequency run time is set to 0000, it will actually be translated to run a frequency for .5 seconds. The same is true for the program run time, 0000 will run the program for .5 minutes.

The "Protocol File = x" feature allows another pre-named file to be selected and loaded by simply dialing in a number from 0 to 9 to select 1 of 10 pre-named protocol files that are on the SD Ram Card. Dial the file number you want to load and then press the RED start/stop button and the file will be loaded. This is how you can have 10 protocol files already set up and you simply have to dial a number in to load the respective protocol file.

In Closing:

NOTE: a protocol file can have more than a 100 different protocols by simply dialing new numbers in for the "Setup=3" and "Setup=4" screens. Additionally there can be hundreds of protocol files on the SD Ram Card with other names other than the ten names used by the Generator. With a word processor you could simply rename those files with one of the names the Generator will recognized. Also you can simply switch out the SD Ram Card with another one that has different protocols recorded on it. Your options are virtually unlimited on how you want to organize your protocols.

BATTERY INFORMATION:

Running the Generator from a lithium ion battery couldn't be easier. Instead of plugging in a wall power module to provide 12 volts for the Generator, just plug in a 12 volt lithium battery. Search "lithium battery 12 volt" on EBay, Amazon or the supplier of your choice for something that will work. Do not purchase anything smaller than 6 amps 6000 milliamps. A test was done with a 12 amp battery and it ran for more than 10 hours and it still was running strong. Lithium batteries are great for portable operation or **power outages**.