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## ESP 32 single signal 1 output for HHO production, or twin signals 1 and 2 output for operation of a hot water / steam generator (Revision 6)

**A** BCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789-./:;@!#\$%^&\*~\_`{|}~<>[]\~&quot;~&apos;~&grave;~&circ;~&times;~&div;~&frac;~&sqrt;~&pi;~&inf;~&deg;~&cent;~&dollar;~&pound;~&yen;~&euro;~&copy;~&reg;~&trad;~&sup;~&sub;~&sup2;~&sup3;~&sub2;~&sub3;~&frac12;~&frac14;~&frac34;~&frac13;~&frac23;~&frac15;~&frac25;~&frac35;~&frac45;~&frac16;~&frac56;~&frac76;~&frac17;~&frac18;~&frac19;~&frac110;~&frac111;~&frac112;~&frac113;~&frac114;~&frac115;~&frac116;~&frac117;~&frac118;~&frac119;~&frac120;~&frac121;~&frac122;~&frac123;~&frac124;~&frac125;~&frac126;~&frac127;~&frac128;~&frac129;~&frac130;~&frac131;~&frac132;~&frac133;~&frac134;~&frac135;~&frac136;~&frac137;~&frac138;~&frac139;~&frac140;~&frac141;~&frac142;~&frac143;~&frac144;~&frac145;~&frac146;~&frac147;~&frac148;~&frac149;~&frac150;~&frac151;~&frac152;~&frac153;~&frac154;~&frac155;~&frac156;~&frac157;~&frac158;~&frac159;~&frac160;~&frac161;~&frac162;~&frac163;~&frac164;~&frac165;~&frac166;~&frac167;~&frac168;~&frac169;~&frac170;~&frac171;~&frac172;~&frac173;~&frac174;~&frac175;~&frac176;~&frac177;~&frac178;~&frac179;~&frac180;~&frac181;~&frac182;~&frac183;~&frac184;~&frac185;~&frac186;~&frac187;~&frac188;~&frac189;~&frac190;~&frac191;~&frac192;~&frac193;~&frac194;~&frac195;~&frac196;~&frac197;~&frac198;~&frac199;~&frac1100;~&frac1101;~&frac1102;~&frac1103;~&frac1104;~&frac1105;~&frac1106;~&frac1107;~&frac1108;~&frac1109;~&frac1110;~&frac1111;~&frac1112;~&frac1113;~&frac1114;~&frac1115;~&frac1116;~&frac1117;~&frac1118;~&frac1119;~&frac1120;~&frac1121;~&frac1122;~&frac1123;~&frac1124;~&frac1125;~&frac1126;~&frac1127;~&frac1128;~&frac1129;~&frac1130;~&frac1131;~&frac1132;~&frac1133;~&frac1134;~&frac1135;~&frac1136;~&frac1137;~&frac1138;~&frac1139;~&frac1140;~&frac1141;~&frac1142;~&frac1143;~&frac1144;~&frac1145;~&frac1146;~&frac1147;~&frac1148;~&frac1149;~&frac1150;~&frac1151;~&frac1152;~&frac1153;~&frac1154;~&frac1155;~&frac1156;~&frac1157;~&frac1158;~&frac1159;~&frac1160;~&frac1161;~&frac1162;~&frac1163;~&frac1164;~&frac1165;~&frac1166;~&frac1167;~&frac1168;~&frac1169;~&frac1170;~&frac1171;~&frac1172;~&frac1173;~&frac1174;~&frac1175;~&frac1176;~&frac1177;~&frac1178;~&frac1179;~&frac1180;~&frac1181;~&frac1182;~&frac1183;~&frac1184;~&frac1185;~&frac1186;~&frac1187;~&frac1188;~&frac1189;~&frac1190;~&frac1191;~&frac1192;~&frac1193;~&frac1194;~&frac1195;~&frac1196;~&frac1197;~&frac1198;~&frac1199;~&frac1200;~&frac1201;~&frac1202;~&frac1203;~&frac1204;~&frac1205;~&frac1206;~&frac1207;~&frac1208;~&frac1209;~&frac1210;~&frac1211;~&frac1212;~&frac1213;~&frac1214;~&frac1215;~&frac1216;~&frac1217;~&frac1218;~&frac1219;~&frac1220;~&frac1221;~&frac1222;~&frac1223;~&frac1224;~&frac1225;~&frac1226;~&frac1227;~&frac1228;~&frac1229;~&frac1230;~&frac1231;~&frac1232;~&frac1233;~&frac1234;~&frac1235;~&frac1236;~&frac1237;~&frac1238;~&frac1239;~&frac1240;~&frac1241;~&frac1242;~&frac1243;~&frac1244;~&frac1245;~&frac1246;~&frac1247;~&frac1248;~&frac1249;~&frac1250;~&frac1251;~&frac1252;~&frac1253;~&frac1254;~&frac1255;~&frac1256;~&frac1257;~&frac1258;~&frac1259;~&frac1260;~&frac1261;~&frac1262;~&frac1263;~&frac1264;~&frac1265;~&frac1266;~&frac1267;~&frac1268;~&frac1269;~&frac1270;~&frac1271;~&frac1272;~&frac1273;~&frac1274;~&frac1275;~&frac1276;~&frac1277;~&frac1278;~&frac1279;~&frac1280;~&frac1281;~&frac1282;~&frac1283;~&frac1284;~&frac1285;~&frac1286;~&frac1287;~&frac1288;~&frac1289;~&frac1290;~&frac1291;~&frac1292;~&frac1293;~&frac1294;~&frac1295;~&frac1296;~&frac1297;~&frac1298;~&frac1299;~&frac1300;~&frac1301;~&frac1302;~&frac1303;~&frac1304;~&frac1305;~&frac1306;~&frac1307;~&frac1308;~&frac1309;~&frac1310;~&frac1311;~&frac1312;~&frac1313;~&frac1314;~&frac1315;~&frac1316;~&frac1317;~&frac1318;~&frac1319;~&frac1320;~&frac1321;~&frac1322;~&frac1323;~&frac1324;~&frac1325;~&frac1326;~&frac1327;~&frac1328;~&frac1329;~&frac1330;~&frac1331;~&frac1332;~&frac1333;~&frac1334;~&frac1335;~&frac1336;~&frac1337;~&frac1338;~&frac1339;~&frac1340;~&frac1341;~&frac1342;~&frac1343;~&frac1344;~&frac1345;~&frac1346;~&frac1347;~&frac1348;~&frac1349;~&frac1350;~&frac1351;~&frac1352;~&frac1353;~&frac1354;~&frac1355;~&frac1356;~&frac1357;~&frac1358;~&frac1359;~&frac1360;~&frac1361;~&frac1362;~&frac1363;~&frac1364;~&frac1365;~&frac1366;~&frac1367;~&frac1368;~&frac1369;~&frac1370;~&amp

Encoder		<b>Channel 1 variables selectable from encoder wheels / buttons</b>
wheel (W) /		(Channel 1 is for HHO production)
/ button (B)		
designations		
for each channel		
W1		Frequency of the pulses in the pulse train burst = F1 (selecting 'Frequency' is more user friendly)
		Individual pulse total period = P1 (reciprocal of F1 selected by Wheel 1)
W2		Number of pulses in pulse train burst = N1
W2 / Button		Individual pulse total period elongation OR contraction by the
		application of an arithmetic or geometric multiplier (to 2 decimal places) > 1 or < 1 (this is, effectively,
		stepwise non-random decreasing or increasing frequency modulation)
		Note: Pulse on time equates to pulse duty cycle expressed as a % of individual pulse total period
W3		Pulse duty cycle % of each individual pulse = D1 (selectable from 1 to 99%)
W3 / Button		Pulse duty cycle % granular selection (finer than 1%)
W4		Pulse duty cycle % elongation OR contraction by the application of an arithmetic or
		geometric multiplier (to 2 decimal places) either > 1 or < 1
		If the duty cycle % multiplier is set to any value other than 1, then within each consecutively growing
		or shrinking pulse total period (that is if a multiplier has been applied to total pulse period) the duty cycle % of each
		consecutive pulse can also be made to grow or shrink
		If, however, this duty cycle % multiplier is set to 1 and pulse total period elongation or contraction has been selected,
		by the application of a pulse total elongation or contraction multiplier
		then the duty cycle of each consecutively growing or shrinking pulse period will remain constant at the value selected
W5		Pulse voltage threshold value = T1, variable from 0 to 4V?? in 0.1V ?? Increments (ensures a minimum voltage is maintained
		if amplitude above threshold is going to be varying because of the application of a multiplier)
W6		Pulse voltage amplitude (above T1 threshold voltage) = A1 variable from 4V?? to V?? in 0.1V ?? increments)

W7		Gate (off) time = G.
W7 / Button		Gate (off) time elongation OR contraction by the application of an arithmetic or
		geometric multiplier (to 2 decimal places) either > 1 or < 1
		This Gate (off) time multiplier can only be used for channel 1 and HHO production. (If this function were
		also applied to channel 2 when it has been turned on for steam resonator operation, the overlapping
		of channel 1 and channel 2 pulse trains could occur causing HHO to be produced during
		steam resonator operation
		The problem of signal overlapping is even more likely if, by application of a multiplier on either or both
		channels, variable elongation or contraction is being applied to pulse total period and / or if the total
		pulse period has been randomised

<b>Channel 2 variables selectable from encoder wheels / buttons</b>		
(Channel 2 when activated in addition to channel 1 is for steam generator operation)		
We need a button that copies all channel 1 signal characteristics and assigns them to channel 2, so that the signals are identical.		
OR if channel 2 is to be separately variable in all of the ways that channel 1 is, then we need all the following:-		
		Frequency of the pulses in the pulse train burst = F2 (selecting 'Frequency' is more user friendly)
		Individual pulse total period = P2 (reciprocal of F2 selected by Wheel 1)
		Number of pulses in pulse train burst = N2
		Individual pulse total period elongation OR contraction by the
		application of an arithmetic or geometric multiplier (to 2 decimal places) > 1 or < 1 (this is, effectively,
		stepwise non-random decreasing or increasing frequency modulation)
		Note: Pulse on time equates to pulse duty cycle expressed as a % of individual pulse total period
		Pulse duty cycle % of each individual pulse = D2 (selectable from 1 to 99%)
		Pulse duty cycle % granular selection (finer than 1%)
		Pulse duty cycle % elongation OR contraction by the application of an arithmetic or
		geometric multiplier (to 2 decimal places) either > 1 or < 1
		If the duty cycle % multiplier is set to any value other than 1, then within each consecutively growing
		or shrinking pulse total period (that is if a multiplier has been applied to total pulse period) the duty cycle % of each
		consecutive pulse can also be made to grow or shrink
		If, however, this duty cycle % multiplier is set to 1 and pulse total period elongation or contraction has been selected,
		by the application of a pulse total elongation or contraction multiplier
		then the duty cycle of each consecutively growing or shrinking pulse period will remain constant at the value selected
		Pulse voltage threshold value = T2, variable from 0 to 4V?? in 0.1V ?? Increments (ensures a minimum voltage is maintained
		if amplitude above threshold is going to be varying because of the application of a multiplier)
		Pulse voltage amplitude (above T2 threshold voltage) = A2 variable from 4V?? to V?? in 0.1V ?? increments)



Gate (off) time elongation OR contraction would have to be achieved by the application of the same arithmetic or geometric multiplier as applied to channel 1 (to 2 decimal places) either > 1 or < 1		
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The problem of signal overlapping is even more likely if, by application of a multiplier on either or both channels, variable elongation or contraction is being applied to pulse total period and / or if the total pulse period has been randomised

Pulse voltage amplitude above threshold voltage increasing OR decreasing by the application of an arithmetic or geometric multiplier (to 2 decimal places) either  $> 1$  or  $< 1$

Pulse voltage amplitude above threshold voltage increasing OR decreasing by the application of an arithmetic or geometric multiplier (to 2 decimal places) either  $> 1$  or  $< 1$

Option to set individual values for the voltage amplitude (above T1 threshold voltage) of each of a maximum of 10 pulses  
Would it perhaps be possible to "draw" the amplitude profile of 10 successive impulses in Audacity and then import the values generated and apply those values to the ESP32 pulse train?

Again, if we do assign individual and different values to the voltage amplitudes of each pulse (above any set threshold voltage) forming a train of pulses leaving the ESP32 to enter the cell / steam resonator driver circuits, they may have limited, if any impact upon the pulses reaching the primary coil. If we wish to dramatically affect pulse amplitudes acting on the primary to make them vary between a voltage of 0V and 60V we will have to think of another way of achieving that.

If  $G$  is  $< (N^2 + 2) \times P_2$  then signal 2 is to be automatically disabled and is prevented from being generated at all. This is a safe way of avoiding the pulse trains in both channels overlapping each other.

W8 Offset time = OFF = (0 to 99%) x ((G - (N2 x P2)/2)

### INCREASING MULTIPLIERS

**increase geometrically** above the set value of the variable by consecutively applying a geometrically growing

### DECREASING MULTIPLIERS

Limiting function : If as a result of applying a decreasing step value the value of the variable would reach zero, a condition needs to be set such that if the value of the variable becomes lower than 1%, say, of the variable value initially set, then the application of the multiplier stops being applied to any subsequent pulses left in the pulse train

multiplier (the initial value of which multiplier can be set manually *below* 1.00 to 2 decimal places)

application of the geometrically *decreasing* multiplier stops being applied to any subsequent pulses left in the pulse train

<b>RANDOMIZATION OPTIONS</b>									
Individual pulse total period (P1 or P2 or both) randomization between 1% of the value of variable set and 100% of the value of the variable set.									
This should override and replace any application of elongation or contraction multipliers (arithmetic or geometric) that may have been applied to the pulse period (P1 or P2 or both)									
Whatever duty cycle % has been selected the same % will be applied to each randomly generated pulse period									
unless of course the duty cycle % (D1 or D2 or both) has also been randomized, in which case the chaos of the signals will be further enhanced !!!									
Duty cycle % (D1 or D2 or both) randomization between 1% of the value of variable set and 100% of the value of the variable set.									
This must override and replace any application of elongation or contraction multipliers (arithmetic or geometric) that may have been applied to the duty cycle % (D1 or D2 or both)									
Whatever pulse total period has been selected the same total pulse period will be maintained but each pulse will have random duty cycles									
unless of course the pulse total period (P1 or P2 or both) has also been randomized, in which case the chaos of the signals will be further enhanced !!!									
Gate (off) time G randomization between 1% of the value of variable set and 100% of the value of the variable set.									
This randomization can only be applied to one channel at a time otherwise uncontrolled signal clashing will occur									
This must override and replace any application of elongation or contraction multipliers (arithmetic or geometric) to the Gate (off) time (G).									
Above T1 or T2 threshold voltage, pulse voltage amplitude (A1 or A2 or both) randomization between 1% of the value of variable set and 100% of the value of the variable set.									
This must override and replace any application of elongation or contraction multipliers (arithmetic or geometric) that may have been applied to the pulse voltage amplitude (A1 or A2 or both)									
Whatever pulse total period and duty cycle % have been selected the same pulse total period and duty cycle % will be maintained but each pulse will have random pulse voltage amplitudes									
unless of course either the pulse total period (P1 or P2 or both) OR the duty cycle % have also been randomized, in which case the chaos of the signals will be further enhanced !!!									
and unless of course both the pulse period (P1 or P2 or both) AND the duty cycle % have also been randomized, in which case the chaos of the signals will be EVEN FURTHER enhanced !!!									
<b>SIGNAL INVERSION OPTIONS</b>									
For each channel individually, ALL pulse trains can be selected to invert.									
For each channel individually, a selectable number of pulse trains can be inverted between a selectable number of non-inverted pulses									
For each channel individually, pulse trains can be randomly inverted									
Any of the above inversion options should be capable of being selected to operate even while any or all of the above signal variation features are operating									
<b>OPTION TO HAVE TYPE 10XA OPERATION WITH OVERLAPPING PULSES</b>									
This would be achieved by the overlapping of identical pulse trains on both channels (so no difference in pulse total period or duty cycle % and no multiplier applied to either of these variables) to create a combined single unipolar pulse train with Convergent Point "Q"									
This could be done by firstly synchronising the signals on each channel and then, without any signal inversion options selected, apply an offset value that is the same as the pulse duty cycle % but which itself is variable from 1% to 100% of that pulse duty cycle percentage value.									
<b>OPTION TO KEEP EXISTING METHODOLOGY OF WIDTH (W) AND SPACE (S) ?</b>									
We may want to also keep the existing methodology of Width (W) and Space (S) ?									

<b>Geometrically increasing progressions should look like this:</b>				<b>Geometrically decreasing progressions should look like this:</b>			
Apply a multiplier (M1 or M2), say, <b>1.2</b> to				Apply the SAME multiplier, say, <b>0.34</b> to			
first pulse selected amplitude of, say, 1.5 (above T1 or T2 threshold voltage) would produce pulses like this:-				first pulse selected amplitude of, say, 1.5 (above T1 or T2 threshold voltage) would produce pulses like this:-			
Initial amplitude selected (A1 or A2)	Pulse number N1 or N2	Multiplier (M1 or M2) <b>1.2</b>	Amplitude value generated	Initial amplitude selected	Pulse number	Multiplier (M1 or M2) <b>0.34</b>	Amplitude value generated
1.5	1	1.2	1.8	1.5	1	0.34	0.51
	2	1.44	2.16		2	0.1156	0.1734
	3	1.728	2.592		3	0.039304	0.058956
	4	2.0736	3.1104		4	0.0133634	0.020045
	5	2.48832	3.73248		5	0.0045435	0.0068153
	6	2.985984	4.478976		6	0.0015448	0.0023172
The above progression can be achieved by using the formula $A \times M^N$				The above progression can be achieved by using the formula $A \times M^N$			
A more aggressive progression could be achieved using the formula $A \times M^N \times 2^{N-1}$				A more aggressive progression could be achieved using the formula $A \times M^N \times 2^{N-1}$			
A fibonacci sequence could also be an interesting multiplier to apply to variables				A fibonacci sequence could also be an interesting multiplier to apply to variables			

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Revision #4

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