

### Function table

<i>fn</i>		P1	P2	P3	P4	P5
0	zero	-	-	-	-	-
1	single shot	frequency	duration	delay	ramp ratio	width
2	constant	frequency	ramp time	-	-	width
3	burst	frequency	burst rate	on/off ratio	ramp ratio	width
4	ramp 2	frequency	ramp time	on time	off time	width
5	ampl. mod.	frequency	-	-	period	width
6	freq. mod.	frequency 1	frequency 2	period	-	width
7	am-fm	frequency 1	frequency 2	freq. period	ampl. period	width
8	chirp	frequency 1	frequency 1	period	-	width
9	random	frequency 1	frequency 2	min. ampl.	width 1	width 2
10	ramp	frequency	-	base	period	width

### Description of the modes

<i>fn</i>		
0	zero	Output signal is switched off.
1	single shot	A single ramped pulse train with a <i>duration</i> of 0.1 to 10 seconds after an initial <i>delay</i> of 0 to 20 seconds. Ratio of ramp time and maximum amplitude time from <i>ramp ratio</i> . <i>Frequency</i> adjustable from 2 to 500 Hz; pulse <i>width</i> from 24 to 400 $\mu$ s.
2	constant	TENS-like mode: <i>frequency</i> adjustable from 2 to 500 Hz; pulse <i>width</i> from 24 to 400 $\mu$ s. During 0 to 10 minutes <i>ramp time</i> , the amplitude increases from zero to 100%.
3	burst	Ramped bursts: <i>burst rate</i> from 0.07 to 10 Hz; pulse frequency from <i>frequency</i> . Relative burst length from <i>on/off ratio</i> . Ratio of ramp time and maximum amplitude time from <i>ramp ratio</i> .
4	ramp 2	Like "ramp", but the amplitude increases from zero. After the increase phase, amplitude stays at 100% during 0 to 10 seconds <i>on time</i> and is then kept on zero during 0 to 10 seconds <i>off time</i> .
5	amplitude modulation	During a <i>period</i> of 0.1 to 2 seconds, the amplitude varies from 0 to 100% and back. Then repeats.
6	frequency modulation	During a <i>period</i> of 0.1 to 5 seconds, the frequency varies from <i>frequency 1</i> to <i>frequency 2</i> and back. Then repeats.
7	am-fm	Simultaneous amplitude- and frequency modulation.
8	chirp	During a <i>period</i> of 0.1 to 10 seconds, the frequency changes from <i>frequency 1</i> to <i>frequency 2</i> . Then it returns to <i>frequency 1</i> and repeats.
9	random	Pulses are generated randomly between time intervals corresponding with <i>frequencies 1</i> and 2, widths between <i>width 1</i> and <i>width 2</i> and amplitudes between <i>min. ampl.</i> and 100%.
10	ramp	During 0.1 to 10 seconds <i>ramp time</i> , the amplitude increases from <i>base</i> to 100%, then drops to zero. Then repeats. Pulses are like "constant" mode.

For all modes the signal is scaled from 0 to 100% by a separate potentiometer.

## **Switches.**

S1 and S2 are toggle switches; S2-S5 and *start* are momentary switches.

S1	Not connected to a digital pin. Switches piezo speaker.
S2	Digital pin 10. Reserved. Currently used for testing.
S3	Digital pin 8. Reserved. Not currently used.
S4	Digital pin 9. Cycles through pulse-generating variants. Standard is adjustable frequency and pulse width. There are two special variants, 1: constantly varying pulse widths and 2: pulse intervals spread around value corresponding to frequency. (except for modes 6, 7, 8 or 9)
S5	Digital pin 5. Send diagnostics report to serial monitor.
start	Digital pin 3. Activates and deactivates output.

## **Potentiometer settings**

These values are found with a specific potentiometer. Other potentiometers may give slightly different values.

	<b>frequency (Hz)</b>	<b>pulse width (µs)</b>
0	2	32
1	2	32
2	7	70
3	30	120
4	65	150
5	105	200
6	150	240
7	215	280
8	295	320
9	400	360
10	500	400

## **LEDs**

- The red LED indicates that the unit is powered.
- The green LED indicates that pulses are being generated. On start-up of the unit, the green LED flashes briefly to indicate that the unit is ready.

(This document applies to version 20 of the firmware.)