EVEESS™

ELECTRIC VEHICLE ELECTRONIC ENGINE SOUND SYSTEM
by SoundRacer

USER MANUAL
for
SoundRacer® Electric Vehicle Sound Module
with Amplifier
EVSMA-1

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The user manual is also available for download on www.evsoundsystem.com

TECHNICAL DESKRIPTION

SoundRacer Electric Vehicle Sound Module EVSMA-1

with 2x20W integrated Class-D amplifier

Engine sound output	**T**wo speaker outputs from 2x20W amplifier
Vehicle engine RPM or speed input signals:	0-5V analog 0-x Hz frequency, 3V-12V pulses CAN bus with an external interface.
MicroSD memory card:	Input signal settings and other parameters are stored together with the sound files on a MicroSD memory card. User can select settings and sounds in the SRFileGen Windows program and store on the SD card.
Engine sounds	Sound files are stored on a MicroSD memory card. Several engine sounds can be stored on the card and the next sound is loaded by pressing a button. Engine sounds included with module: 4-cylinder, Diesel truck, Shelby V8, Lamborghini V10, Lexus LFA V10, Ferrari V12 car sounds. Suzuki GSX and Classic V-Twin motorcycle sounds. Some customer supplied sound files are also on the card. Custom sounds can be developed.
Gear change function	Simulated gear changes at parameter defined RPM. Function is selectable with a connected switch.
Power supply	12-15V DC. Current consumption at 12,4V: No audio out 170 mA, full volume out with one speaker 1,17A. Green LED indicating power supply.
Housing	Box with mounting flanges, 87 x 57 x 39 mm. HAMMOND 1591XXLFLBK.
Connector	Würth WR-MPC3-ST/16. Matching connector female plug: Würth 662 016 113 322. Terminals: Würth 662 001 137 22D EC. Available from SoundRacer AB as complete sets. The connector and wire set CW16 contains 8 pcs of 30 cm wires with terminals in both ends, cut a wire to get two connections. The connector and terminal set CT16 contains 16 terminals for crimp or soldering.
Accessories	EVHS-01 Hall effect rpm sensor with 4 magnets. EVSP31 Weather protected speaker, IP68 CW16 Connector and wire set. CT16 Connector and terminal set. CANM8 Pulse CAN bus interface. 24V or 48V to 12V DCDC converter can be supplied (not in stock)

INSTALLATION

Power supply

Connect a 11-15V DC from the vehicle activation switch to pin 5 (Battery plus). Connect battery ground to pin 7. A fuse, 5A-10A, should be used for the power supply. When the vehicle is switched on, the sound starts with a short revving.

Vehicle engine RPM or speed input signals:

For 0-5V analog signal, connect to pin 16 and ground.
For 0-x Hz frequency, 3V-12V pulses, connect to pin 14 and ground.

If a Hall effect sensor is used, connect red wire to battery plus (pin 5), blue wire to pin 14 and black wire to ground (pin 7).
If the external CAN bus interface is used it is connected to the same pins.

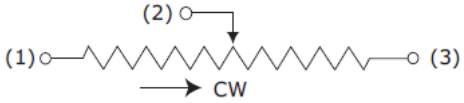
MicroSD memory card:

Insert a MicroSD memory card with prepared files. See SoundRacer File Generator for details.

Sound volume control:

There is an on-board potentiometer for setting output volume, see picture.

For external volume control, set the on-board potentiometer in the middle position and connect a 10-50kohm potentiometer (not included) as follows: Connect (1) to ground, (2) to pin 9 and (3) to pin 6.



Gear change function

Connect a switch (not included) to pin 12 and ground for gear selection or connect pin 12 to ground for permanent gear change function.

Engine sound selection

Connect a switch (not included) to pin 8 and ground. Momentarily activate the switch to load the sound file with the next higher version number.

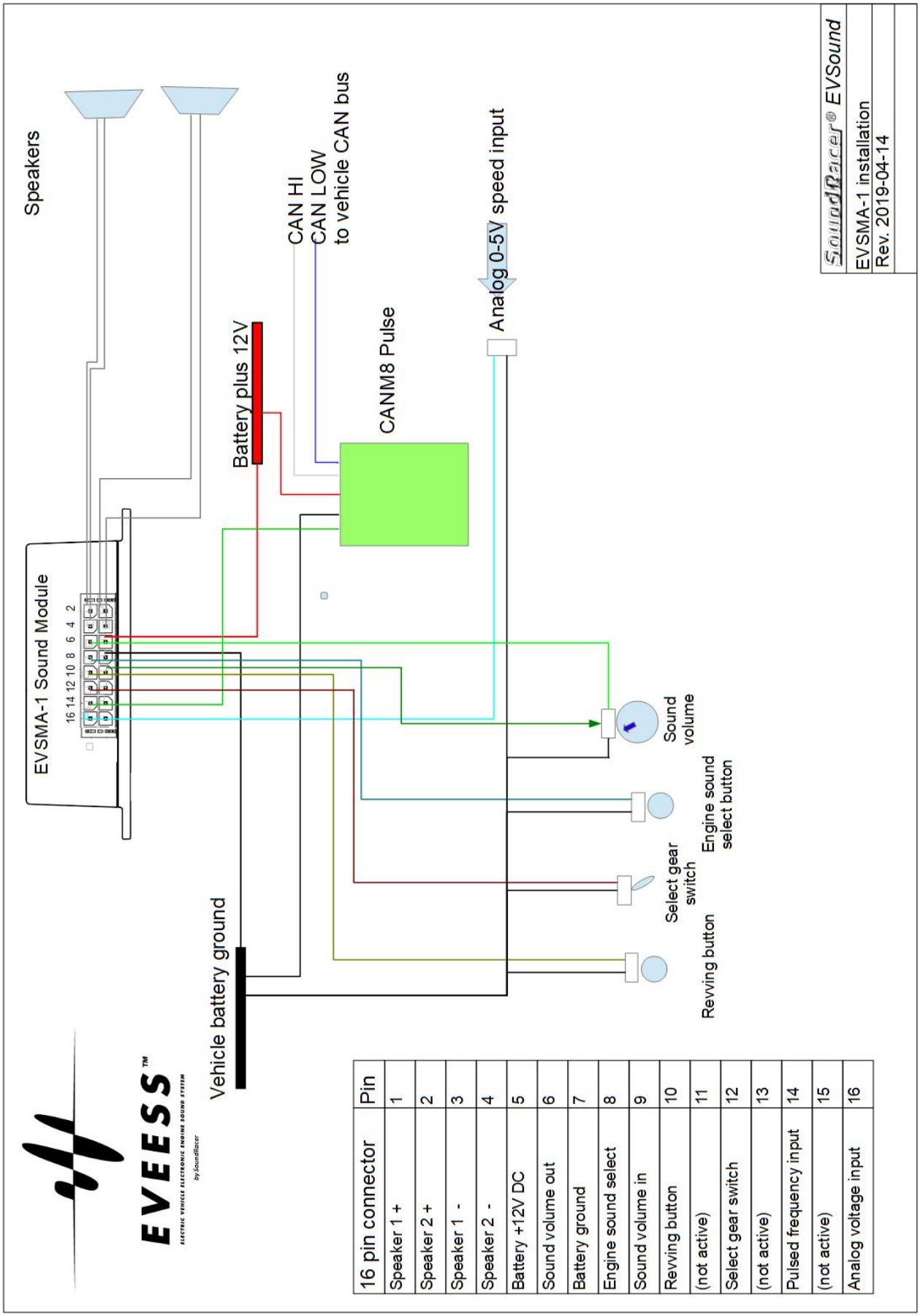
Engine sound revving

Connect a switch (not included) to pin 10 and ground. Momentarily activate the switch to increase the engine sound RPM.

Engine sound output

Connect one or two 4-8ohm speakers to pins 1-3 and 2-4.
For line out to external amplifier, see page 14.

INSTALLATION DRAWING CAN BUS INTERFACE or ANALOG SIGNAL



16 pin connector	Pin
Speaker 1 +	1
Speaker 2 +	2
Speaker 1 -	3
Speaker 2 -	4
Battery +12V DC	5
Sound volume out	6
Battery ground	7
Engine sound select	8
Sound volume in	9
Revving button	10
(not active)	11
Select gear switch	12
(not active)	13
Pulsed frequency input	14
(not active)	15
Analog voltage input	16

CANM8 CANNECT PULSE x4

Quick Overview

CAN Bus Speed Pulse Interface for connection to EVSMA-1

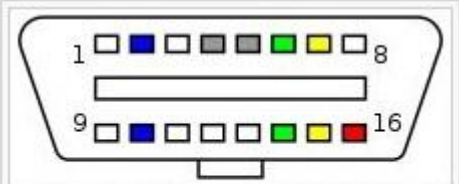
The interface features a mini wiring connector, which unplugs to allow easy installation. There are 2 connections to the vehicle CAN Bus wiring (CAN HI & CAN LO) along with a connection to a permanent, fused 12v power supply and an earth connection.

The CANM8-PULSEx4 interface senses vehicle speed via the CAN Bus and provides a 12v square pulsed output for every 11 cm of vehicle movement, approximately 4 pulses per second at 1 MPH/1,6 km/h.
(There is also a standard version of the interface that has 1 pulse per second at 1 MPH/1,6 km/h but for EVSMA-1 we recommend the x4 model for better resolution.)

The interface incorporates a multi-function miniature status LED, which indicates correct connection to the CAN system, CAN activity present and confirmation that the CAN identity has been recognized.

The LED Status is as follows:

Flashing Red:	Searching for CAN Information.
Solid Red:	CAN Data received but vehicle type not identified yet.
Solid Green:	CAN Data received, and vehicle type recognized.
Flashing Green:	Vehicle speed detected.



Female OBD-II connector pinout - front view

Wiring Installation Details

Car connections:	OBDII connector pin number on most cars	
WHITE -	CAN HI	6
BLUE -	CAN LO	14

SoundRacer EVSMA-1 connections:	16 pin connector
BLACK - 0V	Pin 7
RED - 12V	Pin 5
GREEN - 12V Speed Pulse Output	Pin 14

Parameter 8 setting for SoundRacer EVSMA-1:
Select vehicle speed for max simulated rpm from EVSMA-1.

Example	speed in MPH	speed in km/h	Parameter 8
	50	80	200
	75	120	300

Sound files on MicroSD card have parameter 8 set to 200

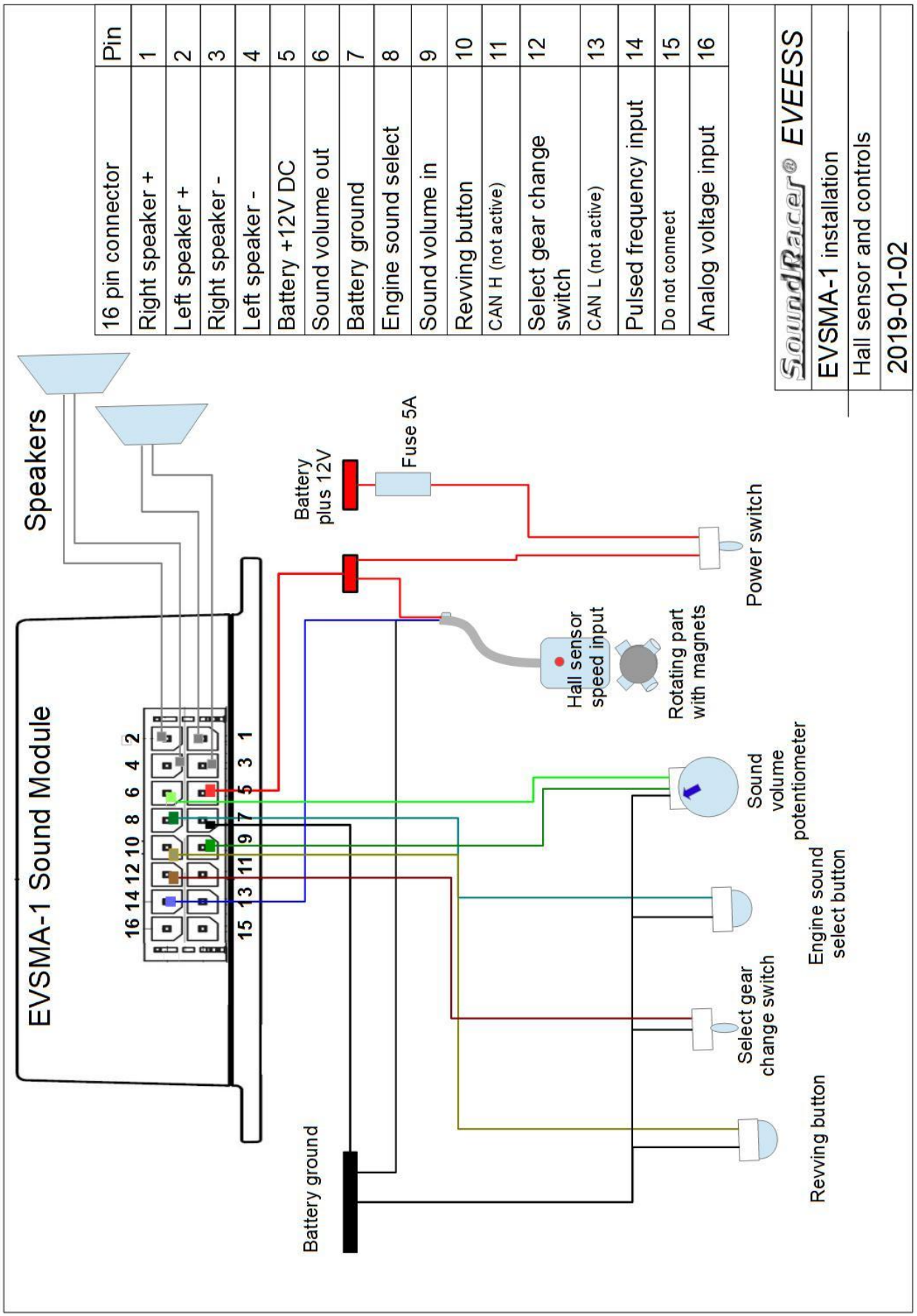
Files and setting calculator for AVAS are on the MicroSD card.

Contact SoundRacer to get instructions for connecting to CAN bus in electric and hybrid cars like Tesla, Leaf, Volt, Lexus, Honda, Renault Zoe, Ford and other.

The CAN interface manufacturer does not specify any CAN protocol data for the interface, only compatible vehicles in the following list and all J1938 Vehicles:

https://www.canm8.com/can-bus-interfaces/speed-pulse-interfaces/canm8-pulse.html

INSTALLATION DRAWING HALL EFFECT SENSOR



Hall effect sensor LITTELFUSE 55100-3H-02-A

- High switching speed up to 10 kHz
- Long life; up to 20 billion operations
- Visual indication of operation
- Unaffected by harsh environments

RPM/speed input signal from Hall effect sensor

The sensor gives one pulse to the EVSM each time a magnet passes the sensor. The time between two pulses is measured by the EVSM and transformed to a corresponding rpm for the sound output. Maximum pulse frequency is set by the user in the SRFileGen program and stored in the file on the MicroSD card. The frequency can be calculated in an Excel sheet that we provide.
For slower revolving parts like a wheel or wheel shaft it is recommended to use four magnets, or more. For faster revolving parts like a motor shaft, two magnets can be used.

Magnets

The magnet south pole must be directed towards the sensor. To find the south pole, just move the magnet near the sensor and check if the sound changes.

Warning, strong magnets! Keep out of reach for children. Dangerous if swallowed. Keep away from credit cards, can erase information.

Installation

The magnets should be adapted to a wheel or shaft evenly distributed. Using two magnets they should be exactly opposite each other, more magnets should have the same distance between them. Different distances will make the rpm uneven.
Install the sensor so that the magnets pass 5 – 10 mm from the sensor.

Black cable is ground

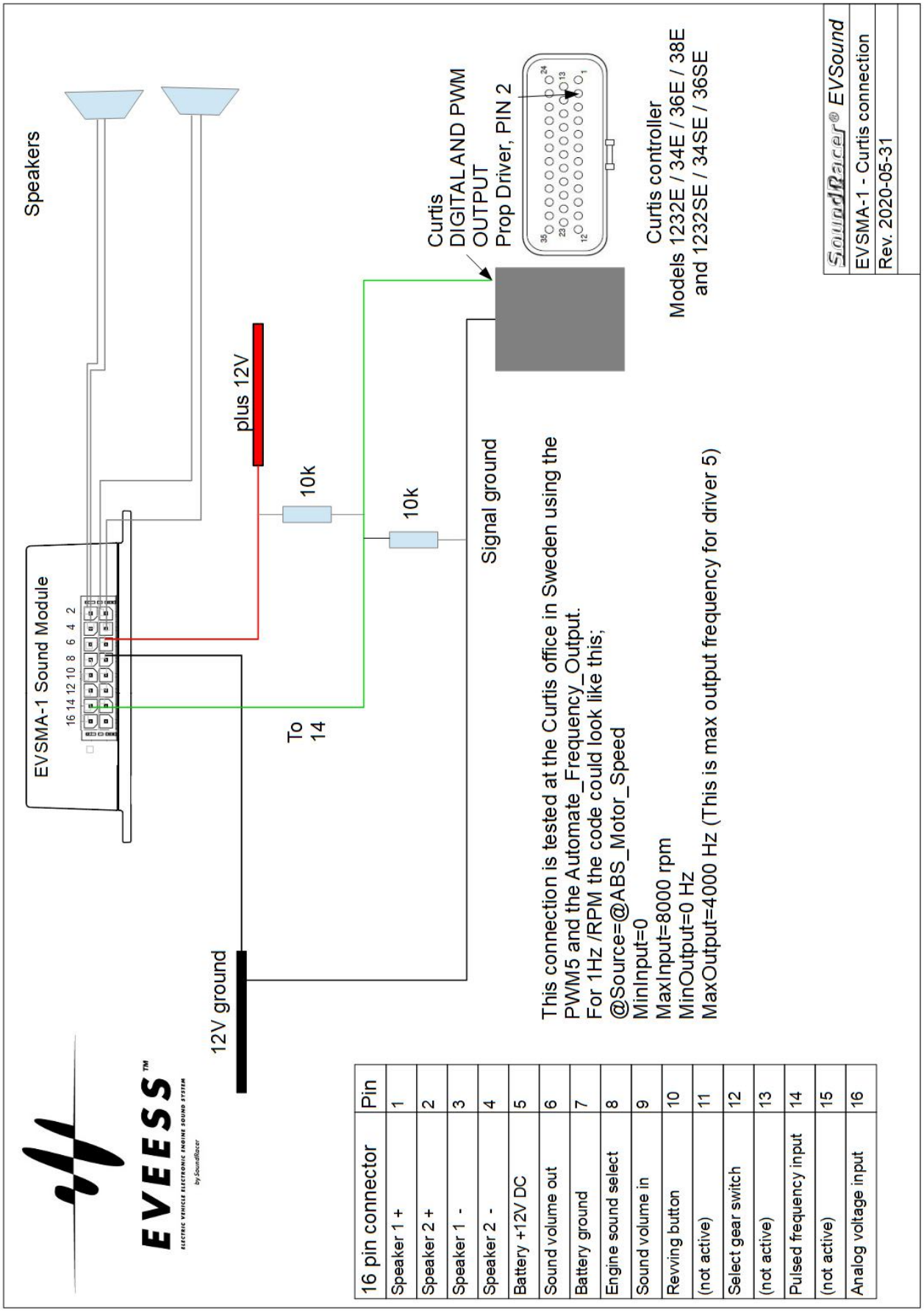
Red cable is DC power in, 4V – 24V, 10 mA

Blue cable is signal out, connect to Pin 14 on EVSMA-1.

A 10k-15k resistor must be connected between red and blue cables.

4 magnets are included with the sensor.

INSTALLATION DRAWING CURTIS CONTROLLER

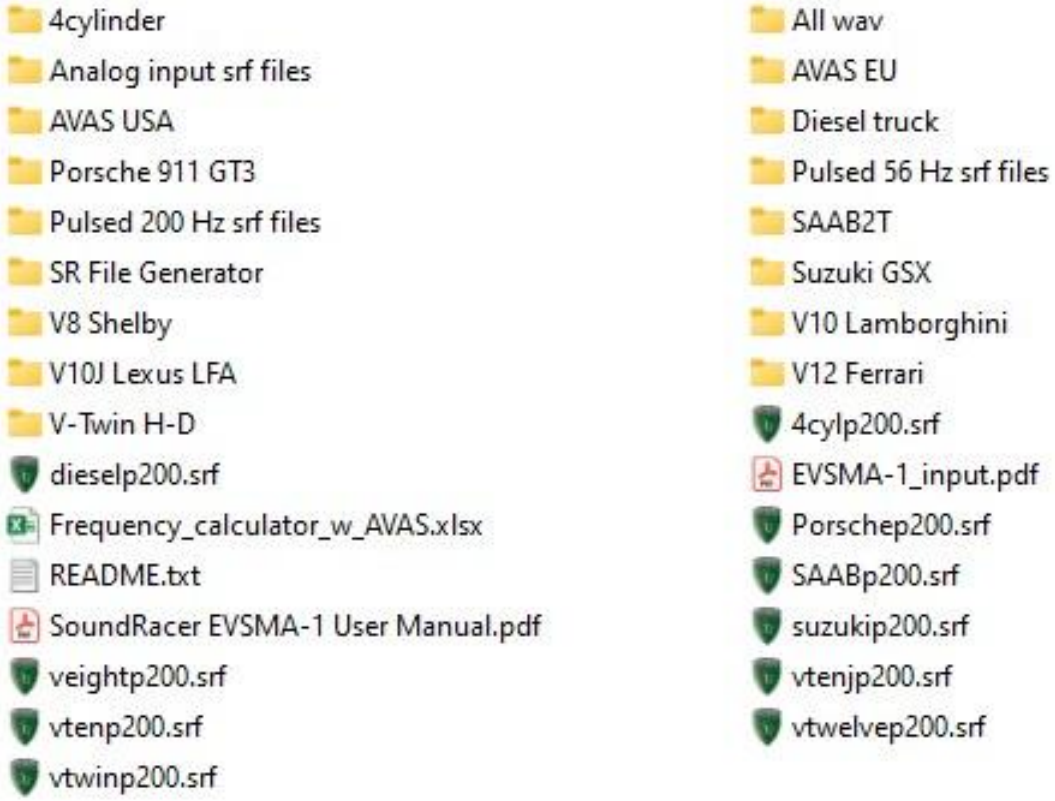


16 pin connector	Pin
Speaker 1 +	1
Speaker 2 +	2
Speaker 1 -	3
Speaker 2 -	4
Battery +12V DC	5
Sound volume out	6
Battery ground	7
Engine sound select	8
Sound volume in	9
Revving button	10
(not active)	11
Select gear switch	12
(not active)	13
Pulsed frequency input	14
(not active)	15
Analog voltage input	16

SOFTWARE AND SOUND FILES

Content of MicroSD card

The MicroSD card delivered with the sound module contains Windows program, sound files and documentation. Here is the content on the card with pulsed 200 Hz files in the root, suitable for CAN bus installation.



List of sound files on the MicroSD card:

Analog voltage speed input		
Sound	**version**	**file name**
V8	108	veight.srf
V10	110	vten.srf
V10J	111	vtenj.srf
V12	112	vtwelve.srf
V-Twin	122	vtwin.srf
Suzuki	123	suzuki.srf
4cylinder	124	4cyl.srf
Diesel truck	125	Diesel.srf
Porsche 911 GT3	126	Porsche.srf
SAAB Sport 2t	127	SAAB2T.srf

Pulsed 56Hz speed input	
version	**file name**
208	veightp56.srf
210	vtenp56.srf
211	vtenjp56.srf
212	vtwelvep56.srf
222	vtwinp56.srf
223	suzukip56.srf
224	4cylp56.srf
225	Dieselp56.srf
226	Porschep56.srf
227	SAABp56.srf

Pulsed 200Hz speed input	
version	**file name**
250	veightp200.srf
251	vtenp200.srf
252	vtenjp200.srf
253	vtwelvep200.srf
254	vtwinp200.srf
255	suzukip200.srf
256	4cylp200.srf
257	dieselp200.srf
258	Porschep200.srf
259	SAABp200.srf

CANM8 AVAS EU	
version	**file name**
230	veighEU.srf
231	vtenEU.srf
232	vtenjEU.srf
233	vtwelveEU.srf
234	4cylEU.srf
235	dieselEU.srf

CANM8 AVAS USA	
version	**file name**
240	veightUSA.srf
241	vtenUSA.srf
242	vtenjUSA.srf
243	vtwelveUSA.srf
244	4cylUSA.srf
245	dieselUSA.srf

NOTE! You may need to change the version numbers on some of the sound files listed above, to make them load. See more about version numbers on page 12.

Copy all files and folders to a computer before use.

The sound module use a **.srf** file stored in the processor to generate the sound output.

One sound is loaded into the module when tested in factory. If another sound should be used, then a MicroSD card with one or more .srf files must be inserted in the module.

The MicroSD card needs only contain generated .srf files when used in the sound module.

The ...p200.srf files in the root are generated files for 200Hz pulsed speed/rpm input suitable for use with CAN bus input.

If you use pulsed input with 56Hz, or analog input, you must delete the ...p200.srf files from the root and then copy the files from the "Pulsed 56 Hz srf files" or the "Analog input srf files" folder to the root of the MicroSD card.

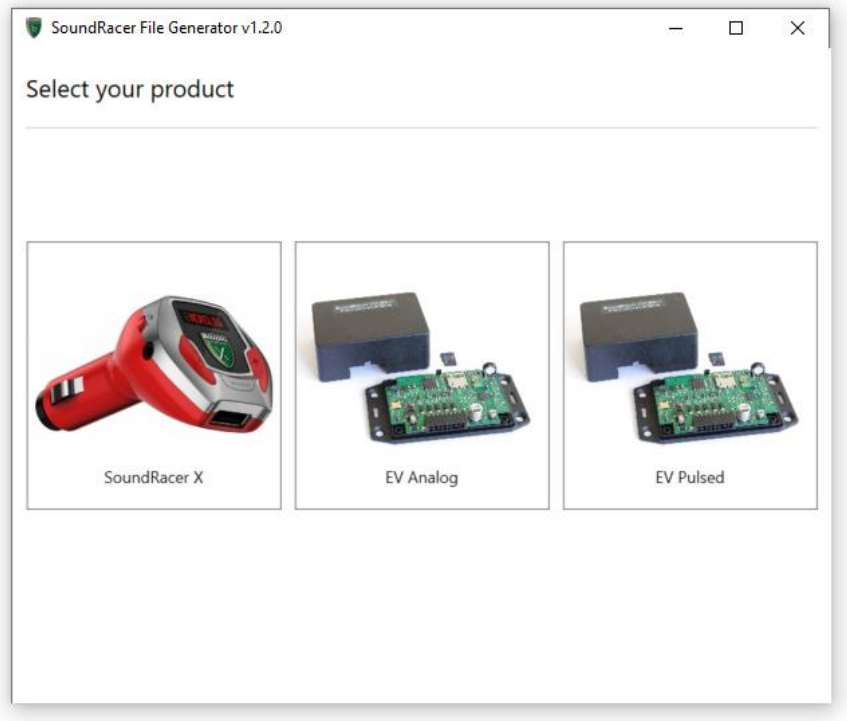
For AVAS use there are folders with .srf files for EU and USA settings. File lists and settings can be found in Frequency_calculator_w_ AVAS.xlsx .

When the correct files are on the card, insert the card int the module and then load a file into the processor as described in the manual.

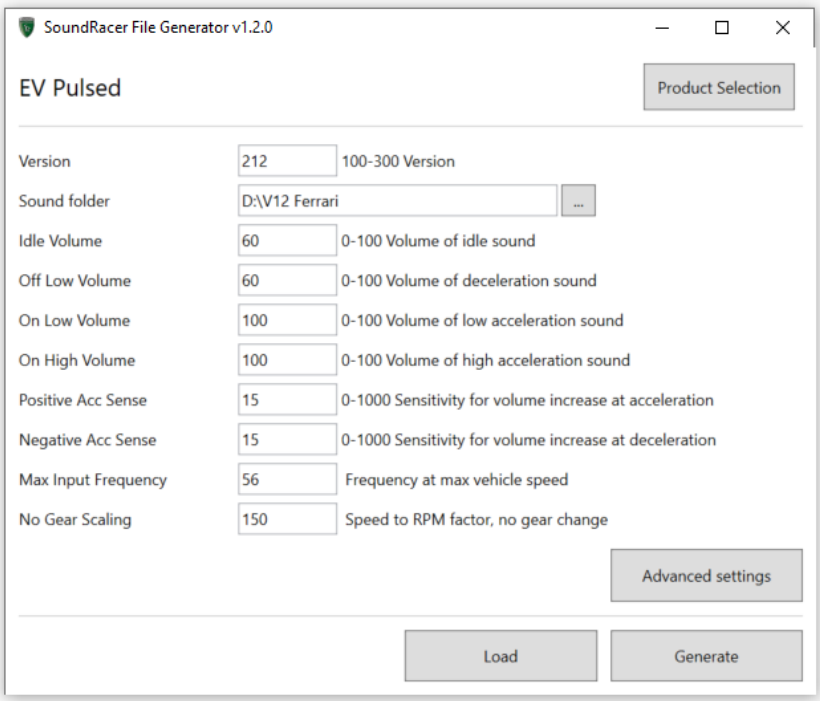
FILE GENERATOR WINDOWS PROGRAM

If you use pulsed input with other frequency range, have the sound muted over a certain speed, as in AVAS, or any other changes, then you must generate .srf files with the proper settings, using the **SRFileGen.exe** program included on the MicroSD card.

The program is also used for our ICE car gadget SoundRacer X Car FM Transmitter.
Select EV Analog or EV Pulsed depending on the input signal type used for the EVSMA-1.



Select Sound path, the folder with the .wav files to be used.



Be sure to set different version numbers on the files, see the User Manual.

Recommended settings for AVAS are found in the CANM8 Parameter_calculator.xlsx

To start generating a .srf file from WAV files, first select a sound folder with the 4 WAV files that should be used.

Then set the parameters as described below.

To copy parameter settings from an existing .srf file, use the **Load** button and select a .srf file.

To generate a .srf file when all settings are made, use the **Generate** button.

Basically, these settings are used.

POSITIVE ACC SENS
Increase the value for faster transitions from deceleration to acceleration sound.

NEGATIVE ACC SENS.
Increase the value for faster transitions from acceleration to deceleration sound.

MAX INPUT FREQUENCY
Enter the pulse frequency for max vehicle speed or rotating shaft rpm

Use Excel calculation **Frequency_calculator_w_AVAS.xlsx** to find the frequency.

NO GEAR SCALING
Speed to RPM factor, increase for higher sound revving

HIGH RPM MUTE, under Advanced settings

In AVAS applications, the sound should fade out (muted) above a certain vehicle speed.

Set to 9900 for no shut off.

The other settings are used for changing the sound character and functions, more info see SOUND PARAMETER SETTINGS.

Enter a 3 digit Version number, range 100-300. Use a unique version number for each file on the MicroSD card. Frequency_calculator_w_AVAS.xlsx contains lists with all .srf files on the MicroSD card and their Version numbers.

NOTE! Version numbers on the MicroSD card does not work for all files due to some limitations in the software. Example: If all Pulsed 200 files are on a card, only the files with version numbers 250-256 will load. If they are removed, version 257, diesel, will load, but not 258 and 259, they have to be renumbered to lower version numbers to load.

In some cases it has also been problem with loading a sound if there is only one .srf file on the card. In that case just load one more file with a different version number.

More information will be published on www.evsoundsystem.com when available.

When the Engine sound select button is pressed, the module search for an .srf with the next higher version number and starts reading the file from the MicroSD card and store it in the processor memory. It takes about 15 seconds, then the sound output starts.
NOTE: If a file on the card has the same version number as the file in the module, the file will not be able to load. Be sure to use different Version number on all files on a card.

If there is no MicroSD card in the sound module it will just use the sound stored in the processor.

SOUND PARAMETER SETTINGS

Parameter 1-4 sets the volume levels for the four different sound

1:	IDLE_VOLUME	= <60>	[0-100]	Volume of idle sound
2:	OFFLOW_VOLUME	= <60>	[0-100]	Volume of deceleration sound
3:	ONLOW_VOLUME	= <100>	[0-100]	Volume of low acceleration sound
4:	ONHIGH_VOLUME	= <100>	[0-100]	Volume of high acceleration sound

Parameter 5-6 sets the transition speed between onlow and offload sounds.

5:	POSITIVE_ACC_SENS	= <15>	[0-1000]	Sensitivity for sound transition at acceleration
6:	NEGATIVE_ACC_SENS	= <15>	[0-1000]	Sensitivity for sound transition at deceleration
(7:	INPUT_TYPE	= <1>	1=Analog, 2=Pulsed)	**Set when selecting product**
8:	MAX_INPUT_FREQUENCY	= <54>	[Hz]	Pulse frequency at max vehicle speed
9:	NO_GEAR_SCALING	= <130>	[%]	Speed to RPM factor, no gear change
10:	SECOND_GEAR_RPM	= <3500>		RPM for change to second gear
11:	THIRD_GEAR_RPM	= <5500>		RPM for change to third gear
12:	FIRST_GEAR_SCALING	= <300>	[%]	Speed to RPM factor, first gear
13:	SECOND_GEAR_SCALING	= <190>	[%]	Speed to RPM factor, second gear
14:	THIRD_GEAR_SCALING	= <130>	[%]	Speed to RPM factor, third gear
15:	MAX_INPUT_RPM	= <7000>		RPM at max input speed
16:	IDLE_SAMPLE_RPM	= <1000>		RPM for idle sound sample
17:	ONLOW_SAMPLE_RPM	= <3500>		RPM for onlow sound sample
18:	IDLE_FADE_OUT_RPM	= <1000>		RPM for start of idle sound fade out
19:	IDLE_END_RPM	= <3000>		RPM for complete idle sound fade out
20:	OFFLOW_BEGIN_RPM	= <1000>		RPM for complete offlow sound fade out
21:	OFFLOW_FADE_IN_RPM	= <3000>		RPM for start of offlow sound fade out
22:	ONLOW_BEGIN_RPM	= <1000>		RPM for start of onlow sound fade in
23:	ONLOW_FADE_IN_RPM	= <1500>		RPM for complete onlow sound fade in
24:	ONLOW_FADE_OUT_RPM	= <3500>		RPM for start of onlow sound fade out
25:	ONLOW_END_RPM	= <6000>		RPM for complete onlow sound fade out
26:	ONHIGH_BEGIN_RPM	= <3500>		RPM for start of onhigh sound fade in
27:	ONHIGH_FADE_IN_RPM	= <6000>		RPM for complete onhigh sound fade in
28:	ONHIGH_END_RPM	= <7000>		Max onhigh RPM
29:	ONLOW_RESTRICT_VOLUME_RPM	= <1800>		RPM for volume limit to reduce interference
30:	HIGH_RPM_MUTE	= <9900>		Set to 9900 RPM for no mute, lower for mute

EXCEL CALCULATOR FOR FREQUENCY SETTING

The Excel file Frequency_calculator_w_AVAS.xlsx is included on the MicroSD memory card.
The worksheets contain calculators for AVAS and Hall sensor applications.

EXTERNAL AMPLIFIER CONNECTION

External amplifiers should not be connected to the speaker outputs pin 1-4.

Use the **Sound volume out** pin 6 for full signal level or use **Sound volume in** pin 9 where the output signal level can be adjusted with the onboard potentiometer to suite the external amplifier or active speaker.

SOUND FILE SPECIFICATIONS

The SoundRacer sounds are recorded and prepared by a professional sound designer.

SoundRacer can recommend sound design consultants, with long-time experience of developing sounds to our customers. They can design any type of sound to match the image and brand of a specific vehicle and company.

For customers who want to develop their own sounds we provide this short description:

A complete sound contains four different sound files:

idle.wav	1000 RPM idling	sampling frequency 11k (11025 Hz)
onlow.wav	3500 RPM acceleration	sampling frequency 22k (22050 Hz)
onhigh.wav	7000 RPM acceleration	sampling frequency 22k (22050 Hz)
offlow.wav	4000 RPM deceleration	sampling frequency 22k (22050 Hz)

Other rpm figures can be used but the proportions should be the same 1:3,5:7:4

Files should be 32-bit floating point WAV. Mono, not Stereo.

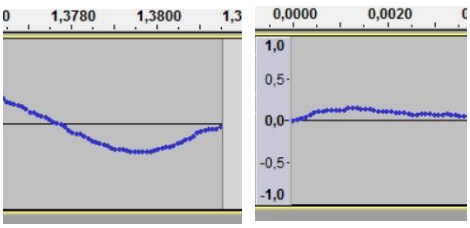
Total size of the four files should be less than 400 kB, meaning that the four files can have a total length of about 9 seconds.

The free Windows program Audacity is very useful for handling the audio files.

http://audacity.sourceforge.net/download/

Each file size must be a multiple of 128 bytes.

Each wav file should be able to loop without a hearable pitch shift or click.
Be sure that the end and the beginning of
the file makes a good match, like this:



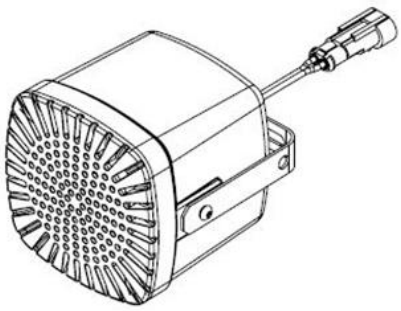
Notes:

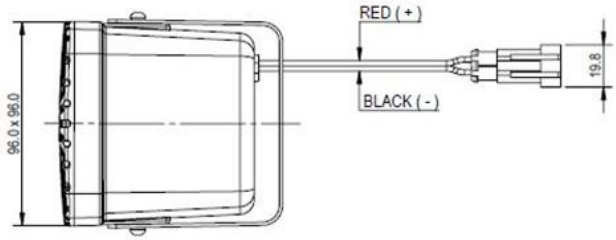
It may not work with comments in the descriptor parts of the wav files.

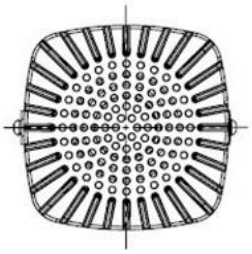
SPEAKER

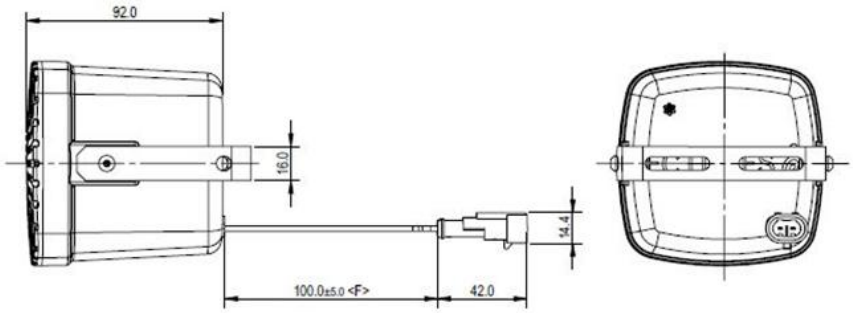
SoundRacer EVSP31 Weather protected speaker

Impedance	4 ohm ±15% at 1 V 500 Hz
Fs	175 Hz ±35 Hz at 1 V
Frequency Response	175 Hz ~ 20000 Hz (-6 dB)
SPL	89 dB / W (1M) ±2 dB
Rated Input	20 W
Max. Input	40 W
Flux	10.000 Gauss (1.0 Tesla)
Buzz and Rattle Test	7 V
Cold/Heat	-40/+105 C
Magnet dimensions	24.8 x 6 N38 Weight: 21 gr (0.735 Oz)
Dimensions	L96mm x H96mm x D90mm
Connection	SuperSeal male connector, Female connector is included.
Weight	340 grams









SoundRacer®
EVEESS™, Electric Vehicle Electronic Engine Sound System

SoundRacer EVS

Acoustic Vehicle Alerting System (AVAS)

Sounds for increased safety around silent vehicles

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