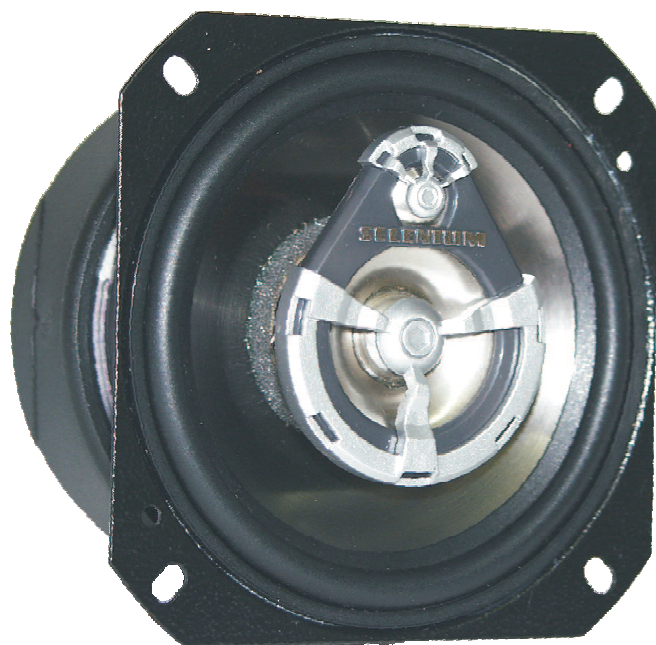


4TR4A

Selenium Multi System consists on a three-way 4" pair of speakers developed to reproduce the whole range of audio frequencies: low, midbass and high frequencies. Whenever used with the right adaptor (if necessary), the three-way is the most indicated loudspeaker to be used in the original car places, avoiding any further work to assemble it. It presents the followings features:

- Polypropylene injected cones with the *vacuum plating* treatment to provide a bold appearance like brushed steel.
- The rubber surround design, without a mechanical break, allowing a linear displacement in both directions assuring low distortion.
- Copper Clad Aluminum (CCAW) voice coil, with the aluminum bobbin for a better heat sink and dumping action, as well as special resins to support high temperatures.
- Steel stamped frame/basket, with a reinforced design and black epoxy finishing.
- Dynamic tweeter with PEI (Polyeter imida) diaphragm/cone and neodymium magnet assure a high performance product.
- The Piezoelectric tweeter has high efficiency at high frequency reproduction.
- 100 W Max power is a big jump from the original low power speakers.



SPECIFICATIONS

Nominal diameter	102 (4)	mm (in)
Nominal impedance	4	Ω
Minimum impedance @ 405 Hz	3.52	Ω
Power handling		
MAX ¹	100	W
AES ²	50	W
Sensitivity (2.0 V@1m) averaged from 90 to 20,000 Hz	87	dB SPL
Power compression @ 0 dB (nom. power)	4.2	dB
Power compression @ -3 dB (nom. power)/2	3.6	dB
Power compression @ -10 dB (nom. power)/10	1.3	dB
Frequency response @ -10 dB	90 to 20,000	Hz

¹ Power handling specifications refer to normal speech and/or music program material, reproduced by an amplifier producing no more than 5% distortion. Power is calculated as true RMS voltage squared divided by the nominal impedance of the loudspeaker.

² AES Standard (100 - 1000 Hz).

THIELE-SMALL PARAMETERS

Fs	98	Hz
Vas	2.74 (0.097)	l (ft ³)
Qts	0.80	
Qes	1.04	
Qms	3.52	
ηo (half space)	0.24	%
Sd	0.0063 (9.76)	m ² (in ²)
Vd (Sd x Xmax)	9.54 (0.58)	cm ³ (in ³)
Xmax (max. excursion (peak) with 10% distortion)	1.75 (0.068)	mm (in)
Xlim (max. excursion (peak) before physical damage)	7.0 (0.27)	mm (in)

Atmospheric conditions at TS parameter measurements:

Temperature	23 (73.4)	°C (°F)
Atmospheric pressure	1,005	mb
Humidity	56	%

Thiele-Small parameters are measured after a 2-hour power test using half AES power. A variation of ± 17% is allowed.

ADDITIONAL PARAMETERS

βL	3.50	Tm
Flux density	0.87	T
Voice coil diameter	31.7 (1.24)	mm (in)
Voice coil winding length	6.0 (19.68)	m (ft)
Wire temperature coefficient of resistance (α25)	0.00372	1/°C
Maximum voice coil operation temperature	190 (374)	°C (°F)
θvc (max. voice coil operation temp./max. power)	1.9 (3.74)	°C/W (°F/W)
Hvc (voice coil winding depth)	7.5 (0.29)	mm (in)
Hag (air gap height)	4.0 (0.16)	mm (in)
Re	3.7	Ω
Mms	5.4 (0.012)	g (lb)
Cms	480.0	μm/N
Rms	0.959	kg/s

NON-LINEAR PARAMETERS

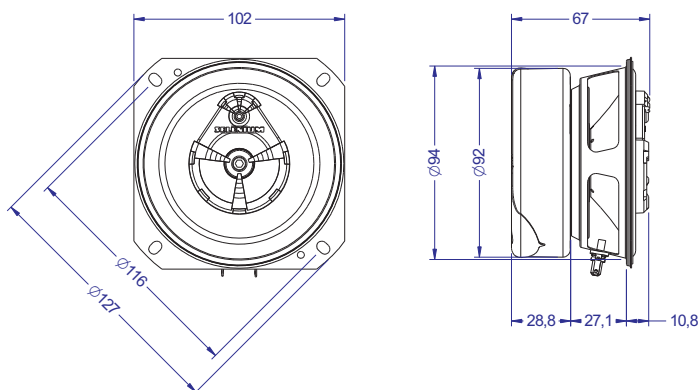
Le @ Fs (voice coil inductance @ Fs)	0.256	mH
Le @ 1 kHz (voice coil inductance @ 1 kHz)	0.192	mH
Le @ 20 kHz (voice coil inductance @ 20 kHz)	0.130	mH
Red @ Fs	0.038	Ω
Red @ 1 kHz	0.286	Ω
Red @ 20 kHz	4.3	Ω
Krm	0.1	mΩ
Kxm	0.9	mH
Erm	0.91	
Exm	0.87	

ADDITIONAL INFORMATION

Magnet material	Barium ferrite
Magnet weight	340 (12.0) g (oz)
Magnet diameter x depth	85 x 15 (3.34 x 0.59) mm (in)
Magnetic assembly weight	680 (1.5) g (lb)
Frame material	Steel
Frame finish	Black epoxy
Voice coil material	Copper clad aluminum (CCAW)
Voice coil former material	Aluminum
Cone material	Polypropylene
Volume displaced by woofer	0.15 (0.0053) l (ft ³)
Net weight	840 (1.85) g (lb)
Gross weight	1,780 (3.924) g (lb)
Carton dimensions (W x D x H)	27x26.5x26.5 (10.6x10.4x10.4) cm (in)

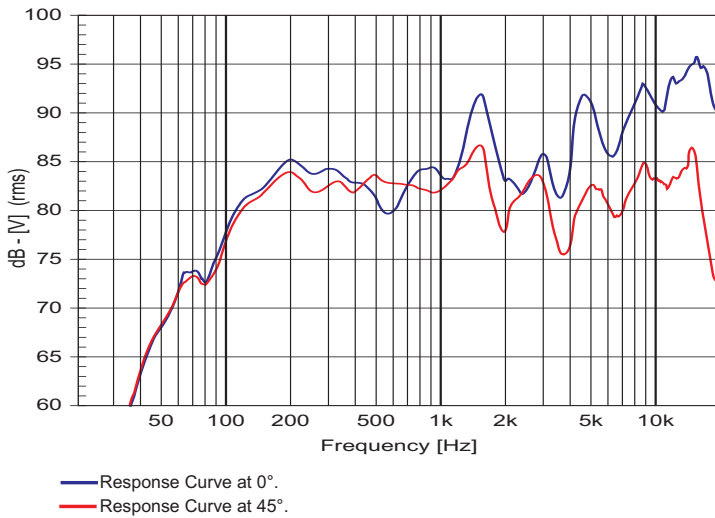
MOUNTING INFORMATION

Number of bolt-holes	4
Bolt-hole dimension	3.2 (0.12) and 5x6.3 (0.19x0.24) (ears) mm (in)
Bolt-circle diameter	107 (4.21) and 114 (4.49) (ears) mm (in)
Baffle cutout diameter (front mount)	100 (3.93) mm (in)
Baffle cutout diameter (rear mount)	94 (3.70) mm (in)
Connectors	Push on terminals
Polarity	Positive voltage applied to the positive (+) terminal gives forward cone motion
Minimum clearance between the back of the magnetic assembly and the enclosure wall	N/A (-) mm (in)

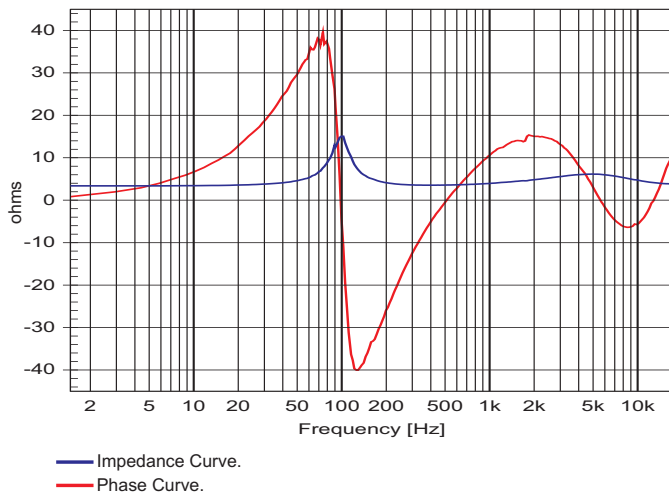


4TR4A

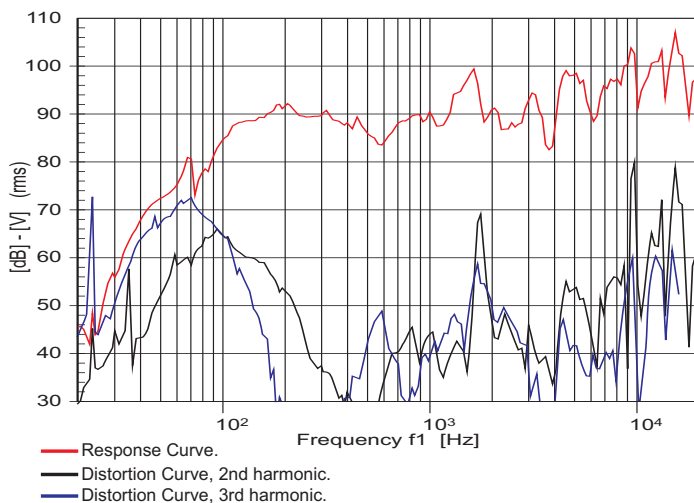
RESPONSE CURVE (0° AND 45°) IN A TEST ENCLOSURE INSIDE ANECHOIC CHAMBER, 1W / 1 m



IMPEDANCE AND PHASE CURVE MEASURED IN FREE-AIR



HARMONIC DISTORTION CURVES MEASURED AT 10% AES INPUT POWER, 1 m



TEST ENCLOSURE Closed box with 455 l.

HOW TO CHOOSE THE RIGHT AMPLIFIER

The power amplifier must be able to supply twice the RMS driver power. This 3 dB headroom is necessary to handle the peaks that are common to musical programs. When the amplifier clips those peaks, high distortion arises and this may damage the transducer due to excessive heat. The use of compressors is a good practice to reduce music dynamics to safe levels.

FINDING VOICE COIL TEMPERATURE

It is very important to avoid maximum voice coil temperature. Since moving coil resistance (R_e) varies with temperature according to a well known law, we can calculate the temperature inside the voice coil by measuring the voice coil DC resistance:

$$T_B = T_A + \left(\frac{R_B}{R_A} - 1 \right) \left(T_A - 25 + \frac{1}{\alpha_{25}} \right)$$

T_A, T_B = voice coil temperatures in °C.

R_A, R_B = voice coil resistances at temperatures T_A and T_B , respectively.

α_{25} = voice coil wire temperature coefficient at 25 °C.

POWER COMPRESSION

Voice coil resistance rises with temperature, which leads to efficiency reduction. Therefore, if after doubling the applied electric power to the driver we get a 2 dB rise in SPL instead of the expected 3 dB, we can say that power compression equals 1 dB. An efficient cooling system to dissipate voice coil heat is very important to reduce power compression.

NON-LINEAR VOICE COIL PARAMETERS

Due to its close coupling with the magnetic assembly, the voice coil in electrodynamic loudspeakers is a very non-linear circuit. Using the non-linear modeling parameters K_{rm}, K_{xm}, E_{rm} and E_{xm} from an empirical model, we can calculate voice coil impedance with good accuracy.