"...I rank the quality, if not the magnitude, of this small California company's achievement up there with Dolby noise reduction and the Compact Disc."

-David L. Clark
Audio, Nov. 1990
on Velodyne's servo-controlled
subwoofer systems.

"The servo-feedback subwoofers, in our experience, produce the purest low frequency sounds of all the designs."

-John E. Johnson, Jr., Ph.D.
Secrets of Home Theater and High Fidelity, Jan. 1995
on Velodyne's servo-controlled
subwoofer systems.

"... it's safe to say that when it comes to woofin' done right, Velodyne's bigger models are probably the safest bet there is."

"If you know subwoofers, you know about Velodyne."

-Corey Greenberg
Home Theater Technology, Feb. 1995
Face Off: Comparison of five subwoofers

Velodyne Acoustics, Inc.
1070 Commercial St. Suite #101
San Jose, CA 95112

408.436.7270 voice
408.436.7276 fax

Models DF-12sc & DF-10sc

OWNER'S MANUAL

12" & 10" Distortion Free (DF) Series
Automotive Servo-Controlled Subwoofers

Superior Design For Superior Sound

Velodyne
AUTOMOTIVE

DISTORTION-FREE
SUBWOOFER

For installation & connections, see the supplied installation / connections manual.

FOR YOUR RECORDS. . .

DATE PURCHASED _____

MODEL PURCHASED _____

DEALER _____

INSTALLED BY _____

SERIAL # _____

WARNING!

Do not power up system before consulting manual. Incorrect installation could result in damage to unit that will not be covered under warranty. Please follow these easy steps before using/installing unit.

- ✓ Please read all instructions first.
- ✓ Due to the sophisticated nature of this equipment, we highly recommend having an authorized Velodyne dealer perform all installation & setup functions.
- ✓ Double check all connections to unit before applying power.
- ✓ Servo control unit must have basic functions set to your installation type before applying power.
- ✓ Final calibration should be set by installer after initial power up.
- ✓ Installation manual MUST be followed precisely during installation process to ensure proper performance and prevent damage to speaker or control unit.

SPECIFICATIONS		**DF-12sc**	**DF-10sc**
THD		<1%	<1%
THD (comparable non-servo subwoofers)		10-25%+	10-25%+
frequency response		13-105hz	15-105hz
sensitivity	(1w/1m)	90 dB	87 dB
excursion capability	(linear)	3/4 in.	3/4 in.
	(max.)	1-1/4 in.	1-1/4 in.
voice coil diameter		2-1/2 in.	2-1/2 in.
magnet weight		54 oz.	54 oz.
nominal impedance		4 ohms	4 ohms
recommended amp power		100 w/min.	100 w/min.
		300 w/max.	300 w/max.
recommended enclosure size * (sealed)		1.7 cu. ft.	1.0 cu. ft.

** Recommended enclosures :*
This product has been designed to perform in any type of enclosure, or in an infinite baffle setup. Performance of the subwoofer system may be tailored to your listening taste by altering the type of enclosure used. Consult installation manual for further details. Power requirements are typically reduced when used in an infinite baffle configuration.

Specifications are subject to change without notice.

Warranty & Service Information

This product is constructed of the highest grade materials and assembled under the strictest possible quality assurance conditions.

Should a situation arise which leads you to believe the product is malfunctioning, please return to your authorized Velodyne dealer first.

Should the product require repair or service, your Velodyne dealer is required to send the product in to Velodyne directly, we do not authorize outside service stations to make repairs to this product.

If you have any additional questions concerning the specific warranty coverage, please consult the supplied warranty & registration card.

Any additional questions which are not covered in this manual should be directed to either your authorized Velodyne dealer or contact us directly at Velodyne . . .

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Congratulations!

Thank you for purchasing a Velodyne product. Your purchase of a Velodyne servo-controlled subwoofer for the automobile shows a desire to achieve the highest possible quality of sound reproduction. This product has been engineered and built to the highest standards to provide you with years of listening pleasure.

The DF-series servo-controlled subwoofers represent a breakthrough in car audio technology. By designing the speaker and proprietary control circuitry from the ground up, we have reduced distortion to an order of magnitude below that of the best speakers currently available. After you listen, we think you'll agree. For the lowest distortion speakers around, there is only one choice. Velodyne, the bottom line in bass.

Care Of Your Velodyne

This product combines both electronic devices and loudspeakers. Care must be taken not to damage either unit. Please take every precaution possible when installing and using the product so damage does not occur.

- Do not allow objects to come in contact with the clear anodized aluminum cone, as the cone is very delicate.
- Use only damp cloth when cleaning either controller housing or speaker. No harsh detergents or chemicals that may damage thesurface.
- Never expose the Servo-Controller housing to moisture.
- DO NOT try to adjust the setup controls in control unit. Refer all adjustments to an authorized Velodyne dealer/installer.
- If any part of your Velodyne Servo-Controlled subwoofer or controller should require service, return unit to your authorized dealer. There are no user serviceable parts inside.

Servo Technology

Velodyne pioneered the use of servo-control technology as a means of reducing distortion over a decade ago. Now, we are the first to offer this revolutionary technology for use in the automobile.

In normal music listening, we are exposed to many forms of distortion. Every component in the signal path adds it's own characteristic distortion to the signal. Since most high quality electronics available now have distortion levels far lower than we are able to hear, that leaves your speakers as the worst offenders. While we scrutinize distortion specifications before we buy an electronic component, we rarely see anyone list distortion on loudspeakers. That is because *traditional subwoofers* (even high quality types) can *produce distortion levels around 25% at typical levels.* Even *at only one watt* input power, *many subwoofers produce* from *8-10% distortion.*

Traditional speakers produce sound by using a cone which is forced to move by an electromagnetic motor. The motor is connected directly to an amplifier, which provides the necessary increase in power to drive the speaker. If a speaker was functionally "perfect", this method would work fine. The problem arises when the fast moving speaker cone is called upon to stop & change direction quickly. The speaker cone may continue to move, resulting in muddy bass with an increased amount of harmonic distortion. Unfortunately there is no way for this traditional system to "control" distortion. Until now.

Velodyne's patented servo-control system uses a "motional feedback loop", which corrects for any distortion. Here's how it works. The music signal that normally goes to your amp is re-routed to our control unit. This unit monitors the music signal, which *should* be reproduced exactly without distortion. We then mount two accelerometers on the speaker. One accelerometer monitors cone motion, while the other accounts for motion of the vehicle. Now that we can monitor the actual motion of the cone, we can instantaneously compare how well the acoustic output of the speaker matches the music signal. If & when the output from the speaker starts to deviate from the music signal, the servo circuitry modifies the drive signal

Practice Safe Sound

WE WANT YOU LISTENING FOR A LIFETIME!

Used wisely your new sound reproduction equipment will provide you with a lifetime of listening pleasure. Unfortunately, hearing damage from exposure to loud noise is often undetectable until it is too late. Since it is all too easy to keep "turning up the volume" so you can overcome road noise, we would like to issue this word of caution. Velodyne recommends that you avoid prolonged exposure to excessive sound pressure levels. The following list is included for your protection.

Decibel Level	**Example**
40 dB	Quiet library, soft whispers
50 dB	Typical quiet room
60 dB	Office equipment, background noise
70 dB	Vacuum, hair dryer, restaurant
80 dB	Average city traffic
Sustained exposure to levels of noise higher than this can be dangerous to your hearing.	
90 dB	Subway, motorcycle, lawn mower
100 dB	Garbage truck, power tools
120 dB	Live rock concert
140 dB	Gunshot (close range), jet plane
180 dB	Rocket launching pad

Information courtesy of Deafness Research Foundation.

The Velodyne Story . . .

Founded in 1983 by David Hall, Velodyne Acoustics is the result of an effort to bring the discipline of mechanical engineering and the doctrine of common sense to the field of high performance audio- the Silicon Valley approach to sound.

Through innovative thinking and inventive design, the company pioneered the first true servo-controlled subwoofers. The result was both the reference standard for bass reproduction and the foundation for distortion-free listening.

Rejecting the trend toward high-end indulgence or fancy marketing gimmicks with no relevance to improving sound, Velodyne devoted its technical resources to bringing the benefits of ultra-low distortion technology within the reach of all dedicated music lovers. In fact, many state of the art recording studios & homes now feature Velodyne subwoofers as their "reference standard" by which all others should be judged.

With the introduction of Velodyne's Distortion Free Series for the automobile, listeners finally have access to all the details and dynamics that make up the modern listening experience. Anything imperfect originates elsewhere. By design, Velodyne speakers are incapable of error.

to the amplifier. Forcing the speaker's acoustical output into a true representation of the music.

The term "servo" is misused by some manufacturers who use a different motor on their speakers to try and make woofers sound like larger more powerful units. Unfortunately this usually results in a large amount of distortion as well. At Velodyne, we take an already large & powerful speaker, then use motional feedback to create a true "servo" controlled speaker. This reduces distorion and achieves a level of ***sound quality*** never before heard of.

Product Features & Controls

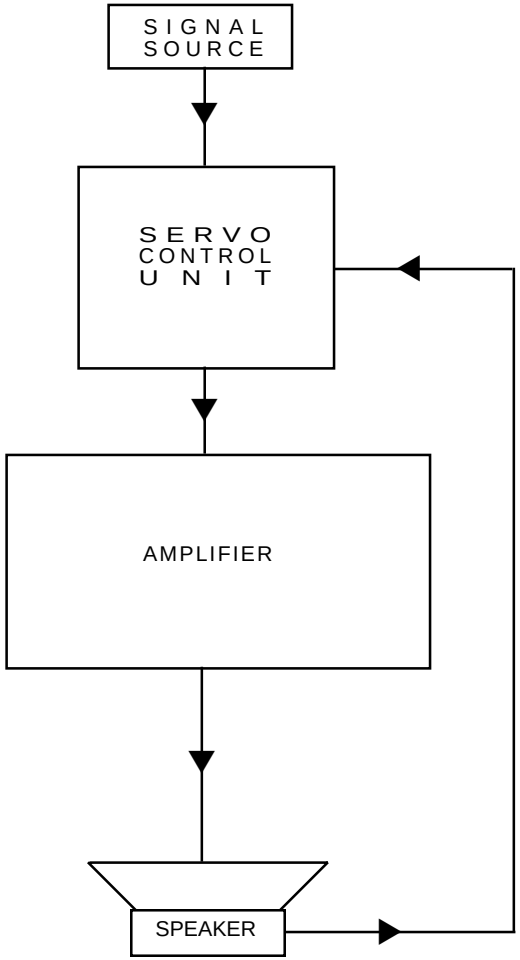
- Rigid cast aluminum basket
- Rubber surround for long excursion and durability
- Rigid spun aluminum alloy cone
- 2-1/2" high temperature voice coil
- Forced air cooling of voice coil
- Gold binding posts accept large guage wire
- Patented High-Gain-Servo control
- Selectable subsonic filter (10 or 30 hz)
- Selectable low pass crossover frequency (60 to 120 hz)
- Optional bypass for low pass crossover
- Remote mounted digital volume control (user adjustable)
- Phase selection (0, 90, 180, 270)
- Enclosure type selection; sealed, infinite baffle, etc.
- Low frequency equalization circuit; to allow use with most amps on the market
- Delayed turn on/off; prevents pops & thumps
- Gain compression circuit; to prevent woofer from over excursion
- Input overload protection
- Thermal power sensing; protects woofer's voice coil from burnout

System Design Suggestions

The Velodyne product you have purchased was designed to offer you the greatest amount of flexibility possible in your vehicle's sound system. However, due to the nature of the servo-control circuitry, there are some suggestions you should observe to avoid any problems and ensure maximum performance. Please read and observe these requirements before proceeding with system installation.

- When choosing an amplifier, it **must** have extended low frequency response down to at least 10 hz
- Optimum performance is typically realized with one dedicated amplifier per woofer
- Amplifier used **must** have gain adjustment
- Amplifier used should be capable of supplying woofer with a minimum of 100 watts RMS
- Maximum suggested amplifier power is 300 watts RMS
- When installed in a sealed enclosure, the unit may require an amplifier towards the high end of the scale (200-300w); when used in an infinite baffle setup, power requirements are reduced and satisfactory performance may be attained with a smaller amp (100-200w)
- Sealed enclosures: accurate sound, simple to build but require more amp power than other enclosures
- Infinite baffle: accurate sound, simple installation, lowest power requirements
- Ported enclosures: much higher output, low power requirements but more complex to build

Servo-System Signal Flow



As you can see from this diagram, the speaker and amplifier now become part of a loop. Actual cone motion is monitored, so now we can control the drive signal to the amplifier. In essence, controlling how the speaker responds.