TI 340
D12 SenseDrive (1.3 EN)

d&b audiotechnik

1. Introduction

SenseDrive enables the D12 amplifier to electrically compensate for the properties of the cable used to connect the loudspeakers and the amplifier output. The result is an increased accuracy in sound reproduction, which is largely independent of the length of the cables used. SenseDrive has previously been used in the d&b A1 amplifier driving d&b B1, B2, F2, M2, F1220, M1220 and F1222 systems.

2. SenseDrive with the D12 amplifier

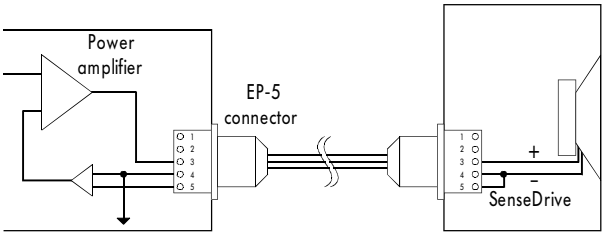
SenseDrive is applied to all d&b subwoofer cabinets using the 5 pin EP5 connector, provided the cabinet input is wired for SenseDrive with a link between pin 4 and pin 5 of the cabinet EP5 input connector. This is available in all Q subwoofer cabinets and other subwoofer cabinets manufactured with EP5 connectors since April 2003, see 9.

SenseDrive is also applied to the LF drivers of the d&b M2 and F1222 2-way active cabinets.

The loudspeaker cables used require 5 conductors with all 5 pins of the EP5 connected. When 4-wire cables are used SenseDrive will not be enabled.

3. SenseDrive

SenseDrive uses the actual voltage arriving at the loudspeaker, which is fed back to the D12 amplifier using the additional conductor.



This connection delivers the voltage at the negative input terminal of the loudspeaker. The difference to the amplifier signal ground is the voltage drop on half of the speaker cable. This signal is multiplied by two and added to the amplifier´s input signal thus producing a corrected output signal that exactly compensates for the losses of the cable and the connectors, so the system behaves as if it is operated with a zero cable length. A useful side effect is the availability of the amplifiers full damping capability at the loudspeaker with no deterioration caused by the resistance of the cable.

4. SenseDrive limitations

The SenseDrive circuit is band limited to avoid signal interferences at higher frequencies and for this reason it is only used in amplifier channels with active low pass filtering to drive subwoofer cabinets or the low frequency drivers in 2-way active systems.

SenseDrive can compensate for the cable losses but it cannot avoid them. If a cable with a total resistance of 1 ohm, for example 70 m (230 ft) of a 2 x 2.5 mm^2 (13 AWG) cable, is used to drive a 4 ohm loudspeaker 20% of the output voltage is lost. This voltage has to be added to the amplifier output, which is not completely possible when the amplifier is operating close to its clipping limits. It is also essential with SenseDrive to keep the cable resistance as low as possible and use speaker cables with sufficient cross section. Our recommendation for the maximum length of the cable run at a given cross section is therefore independent on the use of SenseDrive. Using the following formula the total cable resistance will not exceed 10% of the load impedance:

$$L_{max} = 3\, Z_L \cdot A$$

L_{max}: maximum (single) length of cable [m]
Z_L: load impedance [ohms]
A: cross section [mm^2]

	1.5 mm^2 (15 AWG)	2.5 mm^2 (13 AWG)	4 mm^2 (11 AWG)
Z = 4 ohm	18 m (60 ft)	30 m (100 ft)	48 m (160 ft)
Z = 8 ohm	36 m (120 ft)	60 m (200 ft)	96 m (320 ft)
Z = 16 ohm	72 m (240 ft)	120 m (400 ft)	192 m (640 ft)

Maximum recommended cable runs for different cross sections

When a system is operated at low or medium levels SenseDrive is able to compensate for the effects of longer cable runs. As SenseDrive is not available over the whole system bandwidth, we also recommend that cable runs are limited in these situations. A limit of three times the value listed in the table above will restrict variations in a system frequency response to a maximum of 3 dB.

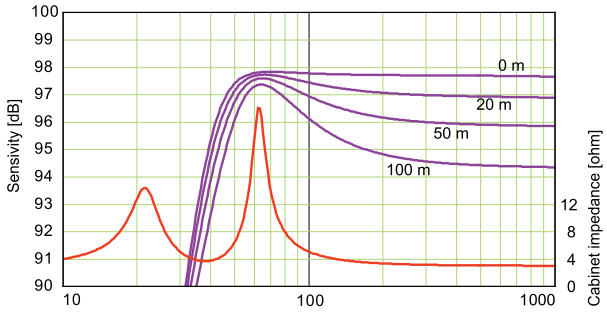
5. The acoustic effect of SenseDrive

SenseDrive has a significant effect on sound reproduction when the resistance of the loudspeaker cable is more than 5% of the nominal load impedance, for instance above half the cable lengths listed above.

Linear effects

The obvious effect of the resistance of the loudspeaker cable is the loss in level caused by the voltage drop in the cable. This voltage drop is dependent on the impedance of the loudspeaker, which varies with frequency. As a consequence the level loss will also depend on the frequency, resulting in a change to the loudspeaker frequency response. The following diagram shows the change in response of a typical 4 ohm loudspeaker without SenseDrive driven through different lengths of cable with a conductor size of 2.5 mm^2. The lower curve is the impedance over frequency of the loudspeaker cabinet. The lower the impedance gets the greater the effect of the cable.

For full range systems this can mean a considerable shift in tonal balance. The low/mid range, which is typically the lowest in impedance, will suffer the largest drop in level when very long cables are used.



The impedance varies significantly over the low frequency spectrum, in particular with vented or bandpass subwoofer designs. So the effect of the resistance of the cable not only changes the level, but also the tuning and sound character of the system.

Non-linear effects

The linear distortion described above could theoretically be corrected with an appropriate equalizer setting, however in practice this is not a satisfactory solution. The impedance curve, which creates the distortion, changes dynamically while the system is in operation. The main reason for this is that the parameters of the loudspeaker drivers change with voicecoil temperature and cone excursion and therefore depend on the operating level of the system. SenseDrive ensures that the signal arriving at the loudspeaker is unaffected by this dynamic behaviour, which is particularly important for subwoofer drivers operating at very high excursions.

6. Multiple loudspeakers connected to one amplifier channel

The signal SenseDrive uses to compensate for the cable effect is derived from one loudspeaker cabinet input only.

Daisy chain

When systems are daisy-chained SenseDrive can only fully compensate the signal for the first loudspeaker cabinet connected to the amplifier. The additional cable run from first to second loudspeaker cabinet is not significant if a comparatively short link cable is used and therefore will not be factored in.

Parallel wiring

When the D12 is set to 2-way active or mix TOP/SUB mode the amplifier OUT A and B output pins are wired in parallel to facilitate various wiring configurations. However the SenseDrive pins are not wired in parallel and provide different functionality in each of these modes.

In the mix TOP/SUB mode only the lower output connector OUT B is wired with SenseDrive for the subwoofer amplifier channel. To enable the SenseDrive function subwoofers must be connected to the OUT B connector. This mode also allows the TOP and SUB cabinets to be wired in a daisy chain from one D12 output connector, however the SenseDrive function will only be enabled when the OUT B connector is used.

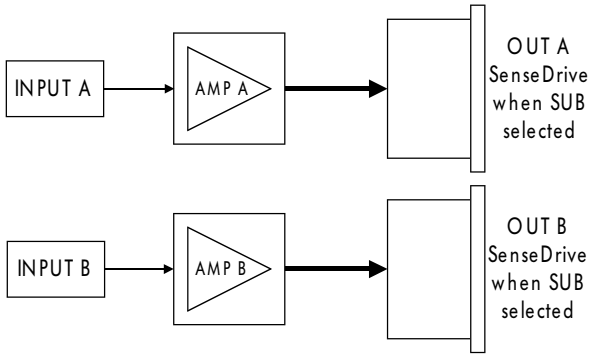
The pin 5 of the input and output EP5 connectors are wired in parallel through all Q-Series cabinets and other EP5 TOP cabinets (excluding MAX/MAX12) manufactured since April 2003, see 9. Consequently in a TOP/SUB configuration it is possible to connect TOP cabinets first and daisy chain the subwoofer cabinets from the link output and SenseDrive will be enabled.

In 2-way active mode for the M2 and F1222 cabinets SenseDrive is derived from the upper output connector OUT A. If only the OUT B connector is used SenseDrive will be disabled.

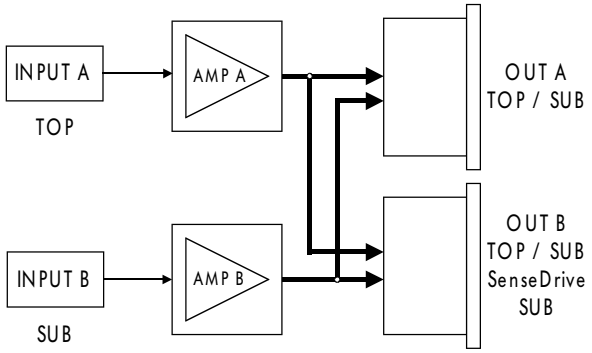
When two active cabinets are individually connected to OUT A and OUT B, the SenseDrive return will be derived only from OUT A. The cabinet connected to OUT B will not have a SenseDrive return and will only perform accurately when identical cable lengths are used on both outputs.

7. D12 output routing

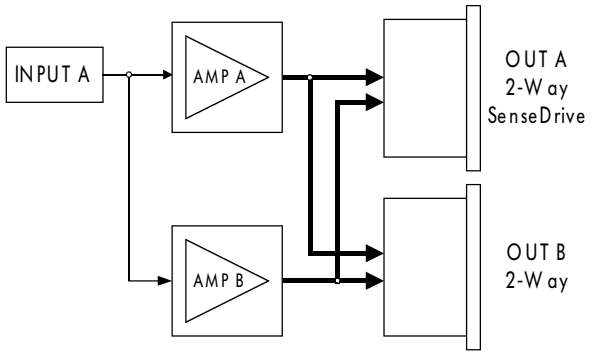
Dual channel



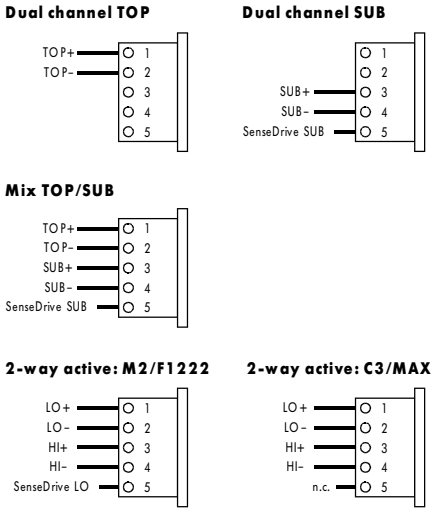
Mix TOP/SUB



2-way active



8. Pin assignments of D12 EP5 outputs



9. Serial numbers of EP5 cabinets wired for SenseDrive

All B1, B2, F1220, F1222, M2 and Q-Series cabinets are wired for SenseDrive.

Other cabinets can be identified using the list below. Cabinets with serial numbers higher than listed in the table have been equipped with an EP5 connector plate wired for SenseDrive. In subwoofer cabinets pin 5 is connected to pin 4 on the EP5 input connector.

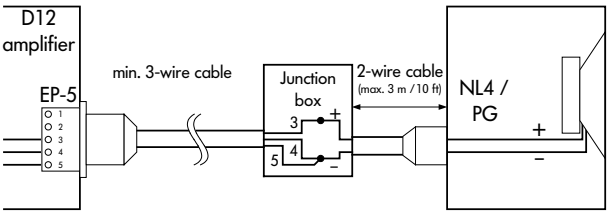
- C4-SUB Z225500100075
- C7-SUB Z225900200087

For TOP cabinets the SenseDrive pin 5 is paralleled from the input to the output connector.

- C4-TOP Z225400100066
- C6 Z225200300014
- C690 Z225250200009
- C7-TOP Z225700200045
- E9 Z225000300003

10. Connecting D12 EP5 outputs to installed loudspeaker cabinets

In permanent installations SenseDrive can also be applied to cabinets with NL4 connectors or fixed cable option (PG). The connection of the negative signal wire (EP5 pin 4 of respective D12 output) to the SenseDrive wire (EP5 pin 5 of respective D12 output) is made in a junction box close to the loudspeaker cabinet. For an uncompromized SenseDrive performance the connection should be done not more than 3m (10 ft) away from the loudspeaker.



11. Connecting D12 EP5 outputs to loudspeakers with CACOM connectors

WARNING!
Dangerous voltage!

To connect B1, B2 and F1222 cabinets with CACOM connectors a cable fitted with a CACOM male cable connector needs to be used.

- To eliminate the potential risk of electrical shock under no circumstances touch the accessible pins.
- The respective amplifier should only be switched on after all cables are plugged in.

d&b B1, B2, F1222 and M2 cabinets with CACOM connectors can be operated by the D12 amplifier with an EP5 to CACOM adapter cable. As the systems use different pin assignments various types of adapters are necessary. The pin assignments are listed below.

D12	B1-SUB	B2-SUB	F1222	M2
EP5 male	CACOM male	CACOM male	CACOM male	CACOM female
1	/	/	A	A
2	/	/	B	B
3	A	A	G	G
4	B	B	H	H
5	H	F	F	F

Adapters can be placed at the amplifier when using existing 8-wire CACOM cables, or at the loudspeaker when using a five wire EP5 cable. Please note that these require adapters with different CACOM connectors.

12. Connecting D12 EP5 outputs to loudspeakers with NL8 connectors

d&b B1, B2, F1222 and M2 cabinets with NL8 connectors can be operated with the D12 amplifier with an EP5 to NL8 adapter cable. The pin assignments are listed below.

D12	B1/B2-SUB	F1222/M2
EP5 male	NL8	NL8
1	/	1+
2	/	1 -
3	4+	4+
4	4 -	4 -
5	3 -	3 -

13. A1 mainframe and EP5 cabinets

d&b B1, B2, F1222 or M2 cabinets with EP5 connectors do not have the internal SPEAKER ID that the A1 mainframe needs to detect the loudspeaker. Therefore it is not possible to drive these with the A1 mainframe.

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