TI 360

System check (1.7 EN)

System check function within the d&b D6, D12 and E-PAC amplifiers and remote control via R1

d&b audiotechnik

1. Introduction

System check is a powerful and convenient tool to check the condition of a complete d&b sound system driven by d&b amplifiers D6, D12 (from firmware version 2.04) and E-PAC (from firmware version 4.10). It is preferably used in conjunction with the d&b Remote network and the R1 software.

System check uses the amplifiers' capability to measure the impedance Z connected to its outputs using a sine wave signal created by the DSP section of its controller.

This TI describes the operation of System check locally at the amplifiers as well as remotely using R1.

System check is related to the Load Monitoring feature of the d&b amplifiers. Both functions share the same measuring principle and impedance reference values. While System check uses a single measuring run Load Monitoring supervises continuously by recurring measurements. System check creates a detailed report about the connected loads whereas Load Monitoring is confined to an error message if a fault is detected.

2. System check procedure

The typical procedure using System check is as follows:

2.1 System setup and calibration

After the system is fully set up, all connections should be checked and verified. Mute all amplifier channels. The correct wiring of the system can now be tested by listening to each channel separately using an appropriate audio program and the MUTE switches - preferably controlled by R1.

Next execute a calibration. The calibration process identifies the actual load impedances for each channel at 10 - 15 Hz (LF driver) and 20 kHz (HF driver). With SUB configurations only 10 - 15 Hz is tested. The result will be stored as a reference and used to calculate the upper and lower limits for the tolerance band.

To verify the correct connection of cabinets and amplifiers, the calibration result can be compared with the typical impedance values for the d&b loudspeakers as listed in Table 4 on page 7.

2.2 Checking the system

Executing a System check after the event will repeat the measurement and display where the values are outside of the tolerance band indicating a possible damage to system components.

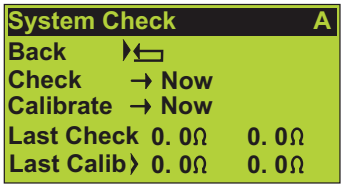
When a sound system is used repeatedly in the same configuration for which a calibration file exists, the System check procedure can also be used before the show to verify the system's correct setup.

A System check will only return valid impedance values when the amplifier had been either calibrated before with the respective load connected or a valid calibration file had been loaded using R1.

3. The D6/D12/E-PAC System check menu

With the E-PAC the System check menu is accessible from the Main menu switching into the Settings menu ⇒ Audio Setup ⇒ Speaker ⇒ scroll down below the Levels menu and select the System check menu.

With the D6/D12 the System check menu is accessible from the Main menu switching into the Settings menu ⇒ Ch A (or Ch B) ⇒ scroll down below the Levels menu and select the System check menu. As the operation is similar the following description for one D6/D12 channel also applies to the E-PAC.



Check:

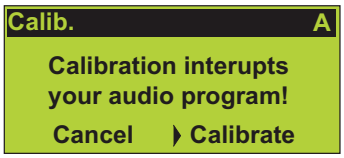
Ensure the system has been calibrated before running the procedure and the respective channel is not muted. Selecting "Check Now" directly starts the measurement. It can be canceled/interrupted and restarted at any time.

After a successful check "OK" will appear.

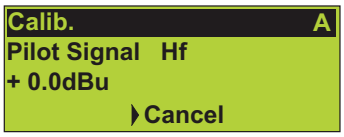
For possible (error) messages during the System check procedure please refer to Table on the last page.

Calibrate:

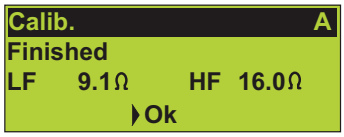
Selecting "Calibrate Now" enters the calibration screen.



Selecting "Calibrate" starts the calibration procedure while the progress of the procedure is displayed. The calibration procedure can be canceled/interrupted and restarted at any time.



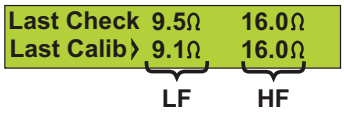
After a successful calibration the reference values will be displayed and "OK" will appear in the bottom line. Confirm to get back to the System check menu.



For possible (error) messages during the System check please refer to Table on the last page.

Last Check:
The actual values derived from the last check are displayed for both the LF and HF sections.

Last Calib:
The reference values derived from the last calibration are displayed for both the LF and HF sections.



4. System check within R1

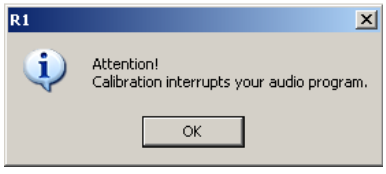
R1 provides a System check module to remotely "Calibrate" and "Check" the system. It is only accessible in Edit mode of the R1 software.

Note: Ensure the remote network is properly set up and R1 is configured correctly. A detailed description of the d&b Remote network via CAN-Bus is given in the technical information TI 312 (d&b code D5312.E).

4.1 Calibrate

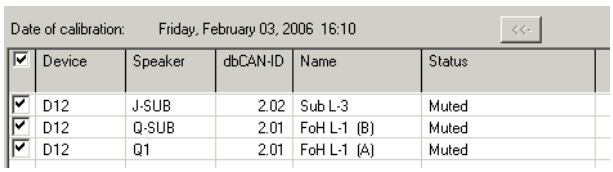
Selecting "Calibrate" R1 directly starts to scan for devices connected to the d&b Remote network. Depending on the number of devices connected this may take a few seconds.

After the scan is completed, the list of devices plus the following message will appear.



Confirm the message with "OK".

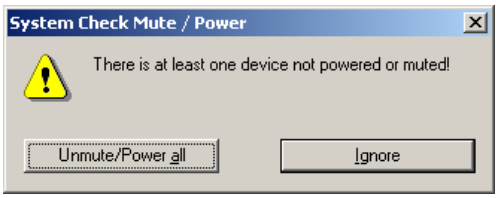
Device list:



From left to right the device list displays the device type, its speaker configuration, its dbCAN-ID and the device name. The next column "Status" is designated for messages and status information during calibration, please refer to Table on the last page.

Selecting devices:
The tick (☑) on the left of each line can be deselected to exclude particular devices from the calibration. The check box located on the left of the header line allows you to deselect all devices. This is useful if you want to select single devices within a long device list, for example.

Starting the calibration procedure:
After having done your selections, click "Calibrate" to start the measurement. Depending on the status of the devices the following message may appear:



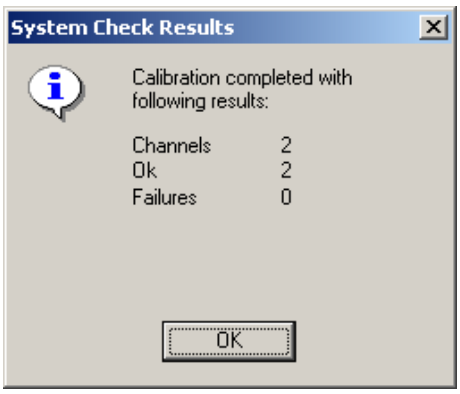
When you press "Unmute/Power all", the selected devices are powered back from standby mode and unmuted to execute the calibration. After the calibration the original status of the devices will be restored.

When you press "Ignore", the respective devices remain in their status. Please note that these units are marked in red and displayed as "Failures" in the "System check Results" message box which will appear after the calibration has been completed.

The calibration procedure can be canceled/interrupted at any time by clicking "Cancel". It can be repeated by clicking "Repeat".

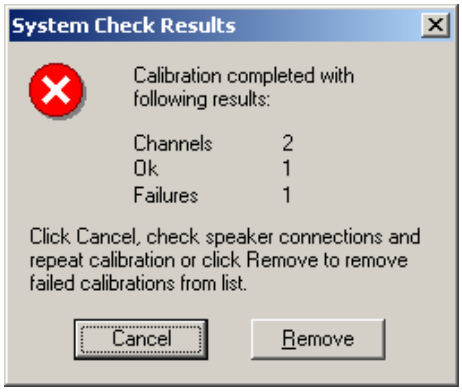
A status bar displays the progress of the calibration procedure.

Calibration results:
After the calibration is completed, the message box "System check Results" will appear. If the calibration is completed without a failure, it will look like this:



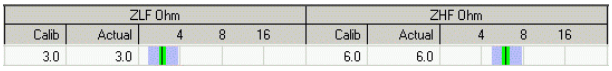
Confirm the message with "OK".

Any failures will be listed in the box:



Proceed following the instructions in the message box.

ZLF Ohm/ZHF Ohm:
The calibration results will be displayed separately for both the LF and the HF sections as numeric values and bar graphs.



With J-Series systems a third section is used to display the impedance of the mid driver (J8, J12) or the rear low driver (J-SUB).

Calib:
Impedance reference value derived from the calibration procedure.

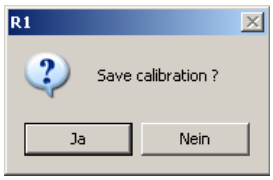
Actual:
Shows the actual measured value. This column is only relevant for the check procedure. In case of the calibration "Actual" and "Calib" are identical by definition.

Bar graphs:
The bar graphs display the impedance and the calculated tolerance windows using a logarithmic scaling. The black line indicates the actual measured value.

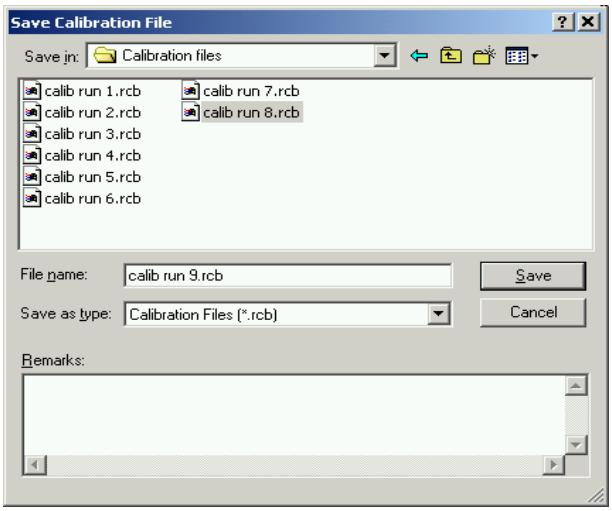
The light blue tolerance band corresponds to the relative threshold values set at each amplifier. The factory settings will work in most applications (D12: –20 % / +30 %). If you want to make sure that amplifiers are set to these default values, use the "Reset Load Monitoring" menu item available in the R1 device list by right clicking on the respective device.

Saving the calibration results
After a successful calibration there are different menu options available:

OK:
Selecting "OK" will display the following message box:



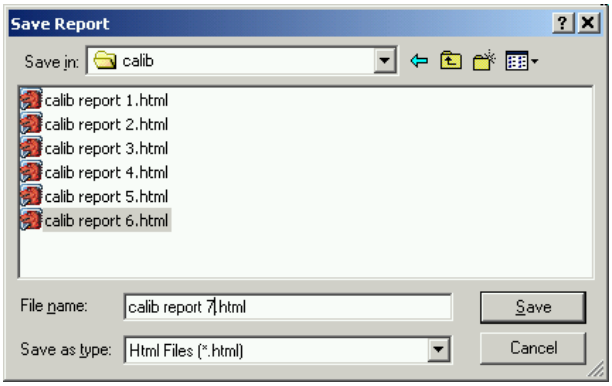
Selecting "No" will exit (cancel) System check. Select "Yes", choose your destination and a useful file name.



Enter your "Remarks" to describe the file and then "Save" it.

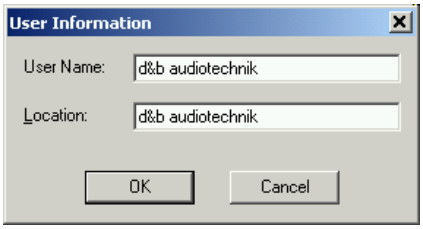
Save:
Saves the calibration results without exiting the System check calibration window.

Save Report:
Selecting "Save Report" saves the calibration results in HTML format. This is useful for filing, viewing or printing the results.



Choose your destination and a file name.

Select "Save" and add user details to the report, see example in Table 3 on page 5.



To exit System check, click "OK" or simply press the escape button (ESC) on your keyboard.

4.2 Check

The "Check" procedure is very similar to the "Calibrate" procedure. After selecting "Check" from the menu, select a previously stored calibration file from your file system and select "Open".

R1 will now scan for devices connected to the d&b Remote network. The devices to be checked can be selected from the list as already described for "Calibration". Click "Check" to start the check run.

Note: Starting the check run R1 first will send the reference values and limits of the chosen calibration file to the respective amplifiers. Local calibration settings of the amplifier will be overwritten.

After all amplifiers have returned impedance data, the results are compared with the calibrated values. The measured values for the LF and HF sections are displayed in the columns "Actual" and by the black line in the bar graph.

The green area marks the range where the system is in perfect condition within the measurement accuracy of the amplifier.

When you use the amplifier default settings, the light blue area covers a –20 % to +30 % range around the nominal value. It indicates the range which usually can be accepted in real life situations. For details see also section Accuracy and resolution on page 6.

If the result is beyond this area, an error message will be displayed in the "Status" column on the right-hand side of the table. For possible error messages please refer to Table on the last page.

An arrow (◀) indicates that the measured value is outside the display range extending from 2 ohms to 32 ohms.

When you select "Save Report", the results can also be stored as a HMTL file as described before in section Calibrate - Save Report on page 4.

To exit System check, click "OK" or simply press the escape button (ESC) on your keyboard.

Date of calibration: Friday, February 03, 2006 16:23 <<-

Device	Speaker	dbCAN-ID	Name	Status	ZLF Ohm					ZHF Ohm					ZMF / ZLF rear Ohm				
					Calib	Actual	4	8	16	Calib	Actual	4	8	16	Calib	Actual	4	8	16
D12	J-SUB	2.02	Sub L-3	Finished	2.9	3.2									5.5	5.9			
D12	Q-SUB	2.01	FoH L-1 (B)	Finished	7.7	8.3													
D12	Q1	2.01	FoH L-1 (A)	Finished	3.0	3.3				6.6	6.6								

Tab. 1: Typical System check result after a normal operation of loudspeakers

Date of calibration: Friday, February 03, 2006 16:23 <<-

Device	Speaker	dbCAN-ID	Name	Status	ZLF Ohm					ZHF Ohm					ZMF / ZLF rear Ohm				
					Calib	Actual	4	8	16	Calib	Actual	4	8	16	Calib	Actual	4	8	16
D12	J-SUB	2.02	Sub L-3	Finished	2.9	2.9									5.5	5.5			
D12	Q-SUB	2.01	FoH L-1 (B)	Finished	7.7	7.6													
D12	Q1	2.01	FoH L-1 (A)	Error LF + HF	3.0	6.0				6.6	13.3								

Tab. 2: Example System check result with error message. One cabinet of a pair of Q1s had not been connected

System Check Report

Name: frank
Location: Lab
Date: Friday, February 03, 2006 16:52

Name	Device	Speaker	dbCAN	ZLF Ohm					ZHF Ohm					ZMF/ZLF rear Ohm					Status
				calib	actual	%	min	max	calib	actual	%	min	max	calib	actual	%	min	max	
Sub L-3	D12	J-SUB	2.02	2.9	3.0	103	2.3	3.8	---	---	---	---	---	5.5	5.6	102	4.4	7.2	ok
FoH L-1 (B)	D12	Q-SUB	2.01	7.7	8.0	104	6.2	10.0	---	---	---	---	---	---	---	---	---	---	ok
FoH L-1 (A)	D12	Q1	2.01	3.0	3.2	107	2.4	3.9	6.6	6.6	100	5.3	8.6	---	---	---	---	---	ok

Tab. 3: Example report

Key:
From left to right. **Name:** Device name, with D6/D12 amplifiers followed by channel indication (A)/(B; **Device:** amplifier type; **Speaker:** selected loudspeaker configuration; **dbCAN:** dbCAN ID; **ZLF Ohm/ZHF Ohm:** Impedance of the low frequency/high frequency section consisting of: **calib:** reference value; **actual:** impedance measured by check run; **%:** Percentage deviation of actual value to reference; **min:/max:** upper and lower tolerance limits: **Status**: Error status of checked device.

5. Accuracy and resolution

The typical accuracy of the determined loudspeaker impedance and thus its relevance regarding possible driver faults depend on a variety of factors. When evaluating the System check result, please keep in mind the following effects:

5.1 Measurement accuracy of the amplifier

The measurement process itself as well as slight differences between different amplifiers introduce possible deviations indicated by the green section in the bar graph display. Best accuracy is of course achieved when identical amplifiers are used for the calibration and the check, as this is typically the case when a system is compared with its status before an event.

The amplifier measurement range is 0 - 99.9 ohms.

The LF measurement of D6/D12 and E-PAC amplifiers uses different signals and algorithms. LF values measured by the E-PAC may typically be 10 % to 20 % higher.

5.2 Cabling and connectors

The same loudspeaker setup measured with different cable types, cable lengths or connectors may produce different results.

5.3 Passive crossover networks

With passive 2-way systems the impedance measured at 20 kHz is not only reflecting the HF driver itself but also the high-pass section of the crossover board in front of it. Depending on the filter design an open circuit HF driver does usually not result in an infinite impedance value.

5.4 Voice coil temperature

The higher the temperature of the voice coil of a driver the higher its DC resistance and consequently the measured impedance. Immediately after an event where the system played at high levels the measured impedances can be up to 50 % higher than cold. If drivers with large magnets have been driven hard for a long time, the cooling process may take an hour or more.

5.5 Ambient temperature

Ambient temperature also affects the voice coil temperature. An installed system calibrated at –10° C will produce up to 20 % higher values when measured at 40° C.

Furthermore the ambient temperature can have a significant influence on the compliance of the LF driver suspension. As a consequence at low temperatures the resonance frequency will be higher and the measured driver impedance value may be lower.

As the D6/D12 uses a more sophisticated measurement algorithm the temperature effect on the measured LF driver impedance is considerably lower than with E-PAC amplifiers.

5.6 Parallel operation of multiple cabinets

When two drivers are operated in parallel, the total impedance is halved, with three drivers it will be a third and so on. If, for example, one low driver out of four fails, the measured impedance will only go up by 33 %. An effect which might get masked when significant temperature effects have to be considered.

5.7 Particular cabinet properties

With some types of cabinets the measurement accuracy is limited by particular effects of the loudspeaker design.

- Q1/Q7/Q10 HF section: The impedance of this type of HF driver shows some narrow resonances in the 20 kHz range. This may lead to bigger deviations between different cabinets than with other designs. Therefore the table below listing typical impedance values shows a nominal range of 12 - 15 ohms for the Q1/7/10. These deviations do not affect the response of the driver in its audible band up to 17 kHz.
- B2-SUB: The bandpass design of the cabinet incorporates a very low tuning frequency. The LF drivers' lower impedance peak may therefore be near the measurement frequencies of System check which results in a reduced measurement accuracy (in particular with B2-SUB cabinets before 01/2005 using d&b L1092 18" drivers). Therefore the impedance table below shows a nominal range of 3 - 5 ohms. The D12 measurement algorithm for B2s has been improved from firmware V2.13. Older firmware versions may identify even higher impedance values for these drivers.

5.8 Interference by audio program

Unlike the calibration process the System check procedure may also be executed while the system is transmitting audio program. However, best accuracy will be achieved without input signal. In particular when the amplifier is driven at a very high level, the test results may be less significant.

6. Tables

6.1 Typical impedance values for d&b systems

The following table indicates typical impedance values for d&b loudspeakers. With correct measurement conditions and relatively short cables measured impedances should be in a range of ±20 % of the listed values (see also section 5. Accuracy and resolution).

The values refer to a single cabinet, when two cabinets are connected in parallel the total impedance is halved, with three cabinets it will be a third and so on.

Please note that the LF values were determined by the D6/D12 measurement algorithm using sine wave signals. A DC resistance measurement with a multimeter may produce different results.

System	Z LF [ohm]	Z HF [ohm]	Z MF LF rear [ohm]
E0	12	11	-
E3	13	21	-
E4	12	11	
E5	14.5	12	
E6	16	20	-
E8	9	16	-
E9	10	13	-
E12/E12-D	8	13	-
E15X-SUB	7	-	-
E12-SUB	7	-	-
E12X-SUB	7	-	-
T10	13	16	-
T-SUB	6	-	-
C3	3	4	-
C4	6	12	-
C7	6	8	-
C6/690	7	15	-
C4-SUB	7	-	-
C7-SUB	5.5	-	-
Ci80	9	16	-
Ci45/60/90	8	13	-
Ci-SUB	8	-	-
Q1/7/10	6	12 - 15	-
Q-SUB	7	-	-
B1-SUB	4	-	-
B2-SUB	3 – 5	-	-
B4-SUB	4	-	-
MAX	6	15	-
MAX12	6	14	-
M2	3.5	9	-
M4	6	13	-
M6	8	13	-
F1222	6	15	-
V8/V12	7.1	17.9	-
V-SUB	5.2	-	-
J8/12	5	15	6
J-SUB	3	-	5.5
J-INFRA	2.2	-	4.1
4S	12	11	-
5S	14.5	11	-
8S	8.1	15	-
10S/S-D/A/A-D	13	13	-
10AL/AL-D	13	14.5	-
12S/12S-D	8	11.5	-
18S/A-SUB	8	-	-
27S/A-SUB	4	-	-
12S-SUB	7	-	-

Tab. 4: Typical impedance values for d&b systems

6.2 Maximum number of cabinets operated in parallel

The following table indicates the maximum number of cabinets which can be operated in parallel by one amplifier channel while a failure of a loudspeaker component will be detected when using the light blue area as fault criteria.

Important note !

The thresholds of the System check function defined by the light blue area (–20 %...+30 %) are also used by Load Monitoring to evaluate the system status. Therefore the values in the table above also apply to Load Monitoring. If more cabinets are operated in parallel, a correct supervision for single component faults is not possible. This is of particular importance for voice alarm and evacuation systems.

System	Failure mode				
	single cabinet disconnected	HF section of single cabinet	single HF/MF driver	LF section of single cabinet	single LF driver
E0	3	2	-	3	-
E3	3	2	-	3	-
E4	3	2	-	3	-
E5	3	2	-	3	-
E6	3	2	-	3	-
E8	3	2	-	3	-
E9	3	1	-	3	-
E12/12-D	3	2	-	3	-
E15X-SUB	3	-	-	3	-
E12-SUB	3	-	-	3	-
E12X-SUB	3	-	-	3	-
T10	3	2	-	3	-
T-SUB	3	-	-	3	-
C3	2	2	1	2	1
C4	3	2	-	3	-
C7	3	2	-	3	-
C6/690	3	2	-	2	-
C4-SUB	3	-	-	3	-
C7-SUB	3	-	-	3	-
Ci80	3	1	-	3	-
Ci45/60/90	3	2	-	3	-
Ci-SUB	3	-	-	3	-
Q1/7/10	3	3	-	3	1
Q-SUB	3	-	-	3	-
B1-SUB	1	-	-	1	1
B2-SUB	1	-	-	1	1
B4-SUB	2	-	-	2	11
MAX	3	3	-	3	-
MAX12	3	3	-	3	-
M2	2	2	-	2	1
M4	3	3	-	3	-
M6	3	2	-	3	-
F1222	2	2	-	2	-
V8/V12	2	1	1	1	1
V-SUB	2	-	-	2	1
J8/12	2	2	2	2	1
J-SUB	1	-	-	1	1
J-INFRA	1	-	-	1	1
4S	3	2	-	3	-
5S	3	2	-	3	-
8S	3	2	-	3	-
10S/S-D/A/ A-D	3	3	-	3	-
10AL/AL-D	3	3	-	3	-
12S/12S-D	2	2	-	2	-
18S/A-SUB	3	-	-	3-	
27S/A-SUB	1	-	-	-	1
12S-SUB	3	-	-	3	-

Tab. 5: Maximum number of cabinets operated in parallel

6.3 General messages and possible error messages during Calibrate and Check

Message within	Procedure	Message	Remark
D6/D12/E-PAC	**Calibrate**	**Calibrating...:**	The calibration procedure is running.
D6/D12/E-PAC	**Calibrate**	**Pilot Signal LF:**	Calibrating the LF signal path.
D6/D12/E-PAC	**Calibrate**	**Pilot Signal HF:**	Calibrating the HF signal path.
D6/D12/E-PAC	**Calibrate**	**Finished:**	The calibration procedure is passed successfully.
D6/D12/E-PAC	**Calibrate**	**Canceled by User:**	The procedure was manually interrupted by the user.
D6/D12/E-PAC	**Calibrate**	**Calibration Error:**	General error.
D6/D12/E-PAC/R1	**Calibrate**	**Power is off:/Not Powered**	The amplifier is not powered or in standby mode and needs to be powered back. Within R1 follow the onscreen instructions.
D6/D12/E-PAC/R1	**Calibrate**	**Amp is Muted:/Muted**	The amplifier (or respective channel) is muted and needs to be unmuted. Within R1 follow the onscreen instructions.
R1	**Calibrate**	**Not powered and muted**	The amplifier is not powered and muted. Within R1 follow the onscreen instructions.
D6/D12/E-PAC/R1	**Calibrate**	**Current too high:**	Short circuit in loudspeaker cable, connectors or cabinet. Solve the problem and run the procedure again.
D6/D12/E-PAC/R1	**Calibrate**	**Current too low:**	Open loop – Loudspeaker cabinet not connected, wrong cable (pin assignment), faulty cable or connectors, loudspeaker damaged.
D6/D12/E-PAC	**Calibrate**	**No Communication:**	Internal error. Try again. Possibly you may switch the unit off and on again.
D6/D12/E-PAC	**Calibrate**	**Generator is used by the Load Monitoring System:**	Frequency Generator is not available if Load Monitoring is enabled.
D6/D12/E-PAC	**Check**	**Canceled**	Canceled by user.
D6/D12/E-PAC/R1	**Check**	**Error:**	General error.
D6/D12/E-PAC/R1	**Check**	**Error LF:**	Possible fault in the LF section.
D6/D12/E-PAC/R1	**Check**	**Error HF:**	Possible fault in the HF section.
D6/D12/E-PAC/R1	**Check**	**Error LF+HF:**	Possible faults in both the LF and HF sections.
D6/D12/E-PAC/R1	**Check**	**Error PwrOff:/Not powered**	The amplifier is not powered or in standby mode and needs to be powered back on. Within R1 follow the onscreen instructions.
D6/D12/E-PAC/R1	**Check**	**Error Muted:/Muted**	The amplifier (or respective channel) is muted and needs to be unmuted. Within R1 follow the onscreen instructions.
R1	**Check**	**Not powered and muted**	The amplifier is not powered and muted. Within R1 follow the onscreen instructions.
R1	**Check**	**Different Speaker setup**	
R1	**Check and Calibrate**	**Address Conflict**	The dbCAN ID is used more than once.
R1	**Check and Calibrate**	**Not Supported**	The respective amplifier firmware does not support System check. Firmware update required: D12 from version 2.04 or higher, E-PAC from version 4.10 or higher

Tab. 6: System check messages

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