TI 312
d&b Remote network (1.5 en)

d&b audiotechnik

1. Introduction

When using the d&b Remote network, the user is able to control and monitor the status of d&b amplifiers with a PC or other suitable computer control equipment.

The d&b Remote network provides control for a wide range of mobile and installed applications, also for large and/or distributed systems. Amplifiers can be operated in user definable groups while at the same time the parameters of each single amplifier channel may be accessed.

The d&b Remote network is based on the CAN-Bus technology. **CAN** stands for **C**ontroller **A**rea **N**etwork and is a two-wire field bus, which was developed by Bosch and Intel in 1985. Originally specified for automotive applications, it has become an industrial standard due to its performance, robustness and economic efficiency.

2. Functionality

The interface provides access to all parameters which are available for local control of the d&b amplifiers. For example:

- input routing
- output routing
- gains and levels
- controller configuration
- delay and equalizer settings
- amplifier temperature
- error status and warnings

Furthermore, over the d&b Remote network an update of the amplifier firmware is possible for single devices or multiple devices of the same type.

3. Components

A d&b Remote network consists of:

- at least one d&b amplifier of the type D6, D12 or E-PAC. The maximum number of amplifiers in the network is 504.
- at least one master device, e.g. a PC running the d&b R1 Remote control software equipped with a CAN interface. Up to two master devices may be operated in the network.

4. Topology

The CAN-Bus is physically carried out in a bus structure.

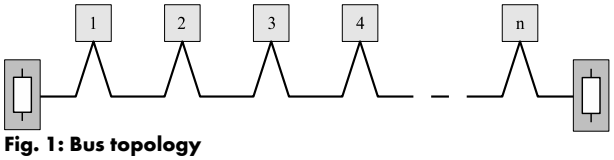


Fig. 1: Bus topology

For a reliable data transmission, a correct termination of the bus at both ends is necessary. An incorrect termination causes high frequency reflections, which interfere with the signals on the bus. This may lead to communication drop-outs, which can be sporadic and not reproducible.

The overall expansion of the network is limited by the propagation speed of the signals on the bus. The voltage level a transmitter sends has to spread throughout the whole bus within the time of a CAN bit. At a bit rate of 100 kBit/sec (dbCAN transmission speed) the maximum bus length is limited to 600 m (2000 ft).

Stub cables

If it is not possible to connect all devices in sequence, a stub cable may be used.

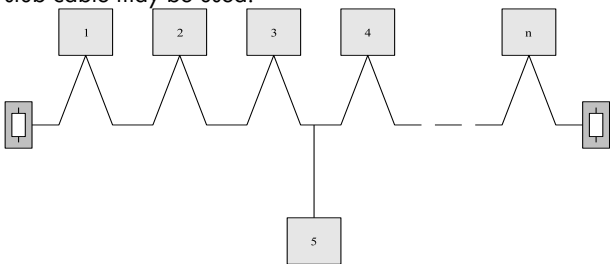


Fig. 2: Stub cable extension

As the bus may only contain two terminating resistors, additional stub cables have to remain unterminated and will therefore generate reflections, which will interfere with the bus signals.

In order not to affect communication, the length of a single stub cable is restricted to 30 m/100 ft. If more than one stub cable is connected to the bus, the sum of all stub cables lengths is restricted to 150 m/500 ft.

CAN signal repeater

A repeater connects two (independent and correctly terminated) bus segments. It consists of a bidirectional signal reproduction and amplification with a certain lock time to avoid signal feedback. Some repeaters also contain opto-couplers for galvanic isolation of the different bus segments.

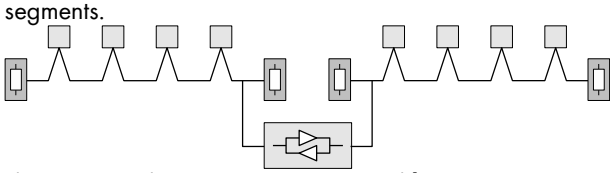


Fig. 3: Connecting two CAN segments with a repeater

Please note that even in this case the maximum overall expansion of the network is limited to the propagation time of the signals. This means the maximum distance between the farthest nodes of the network may not exceed 600 m (2000 ft) minus the internal propagation delay of the repeater (typically 150 ns equal to 45 m).

When using repeaters, it is not only possible to extend the network but also to create different topologies. Star Wiring, for example, can be achieved by connecting a group of stub cables feeding several amplifier locations to the central bus by one repeater each.

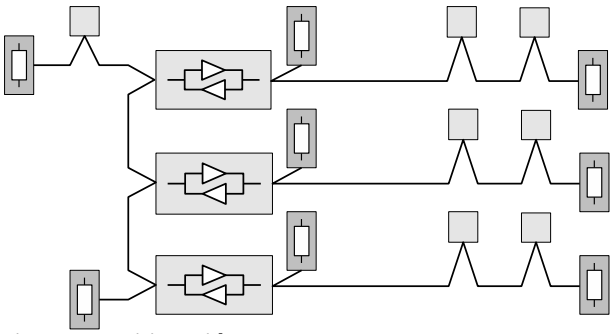


Fig. 4: Star wiring with repeaters

5. Number of CAN nodes

Every CAN node works as transmitter and receiver simultaneously and must be able to drive all other receivers of the bus. The input impedances of the receivers are driven in parallel and therefore the number of CAN nodes is limited to 100.

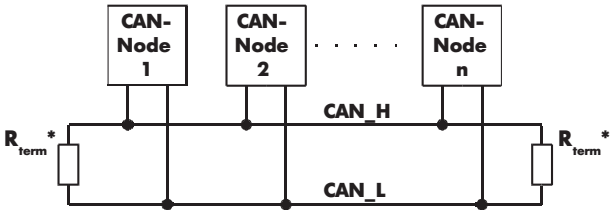


Fig. 5: Connection of nodes to the bus

When more devices have to be operated within one network CAN repeaters can be used to split the bus into several bus segments with up to 100 nodes each.

The overall number of nodes within a CAN network is limited by the number of available dbCAN-IDs, which is 504.

6. Cables

The wiring is done using shielded twisted pair cable with an impedance of 100 to 120 ohms. Suitable cable types are:

- Data cables specified to **CAT5 F/STP** or higher (impedance of 100 ohm). This cable is typically available in 0.25 mm² (24 AWG) and 0.125 mm² (26 AWG), the latter being only recommendable for rack internal wiring.
- **Digital audio cables** which are specified for AES/EBU or DMX 512 (110 ohm)
- Dedicated **CAN cable** (shielded twisted pair cable with an impedance of 120 ohms according to ISO11898.
- **DeviceNet**™ cable (available as "thin cable" 24 AWG and "thick cable" 18 AWG)

Please note that using a conventional microphone cable may work in some applications with short cable runs but is not recommended. Every transmitter must be able to define the valid voltage level throughout the whole bus. As the cables and the CAN nodes form a voltage divider, the maximum length of the wiring is limited. It depends on the number of CAN nodes and the cross-section of the bus cable.

The following table shows the maximum total length (sum of all cables including stubs within one bus segment) depending on the cross section of the wires.

Cable cross section	Maximum bus cable length with number of nodes		
	32	64	100
0,125 mm² (26 AWG)	90 m (300 ft)	80 m (270 ft)	70 m (230 ft)
0,25 mm² (24 AWG)	180 m (600 ft)	160 m (540 ft)	140 m (460 ft)
0,50 mm² (20 AWG)	320 m (1000 ft)	280 m (900 ft)	240 m (800 ft)
0,75 mm² (18 AWG)	500 m (1650 ft)	420 m (1400 ft)	330 m (1100 ft)

Table 1: Maximum total bus cable length

When the required cable length exceeds the listed values, the bus can be split into smaller segments using CAN repeaters.

7. Connectors

Most CAN devices and accessories (like the PEAK CAN Interfaces) use a D-SUB 9 connector. The pin assignment is as follows:

Pin	Signal	Remark
1	-	Reserved
2	CAN_L	CAN low bus line (active low)
3	CAN_GND	CAN ground
4	-	Reserved
5	CAN_SHLD	Optional CAN shield
6	(GND)	Optional ground
7	CAN_H	CAN high bus line (active high)
8	-	Reserved
9	(CAN_V+)	Optional power supply 24V+.

Table 2: D-SUB 9 pin assignment

To enable easy daisy chain cabling the d&b amplifiers are equipped with two RJ 45 connectors, which are linked internally. The assignment is as follows:

Pin	Signal	Remark
1	-	
2	-	
3	-	
4	CAN_H	CAN high bus line (active high)
5	CAN_L	CAN low bus line (active low)
6	-	
7	-	
8	-	
Housing	GND	CAN ground

Table 3: RJ 45 pin assignment on d&b devices

RJ 45 connector

Ensure the RJ 45 connectors of your cables have metal housings connected to the cable shielding.

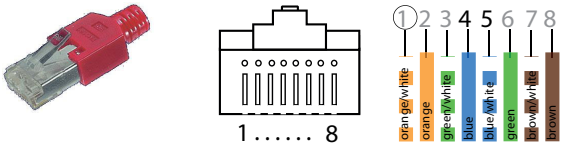


Fig. 6: RJ 45 connector with metal housing (shield - CAN ground), RJ 45 pin number identification (viewed from the front), and color code according to T568B standard.

EIA/TIA-T 568 A standard		EIA/TIA-T 568 B standard (The most common)	
Pin	**Color**	**Pin**	**Color**
1	white/green	1	white/orange
2	green	2	orange
3	white/orange	3	white/green
4	**blue**	**4**	**blue**
5	**white/blue**	**5**	**white/blue**
6	orange	6	green
7	white/brown	7	white/brown
8	brown	8	brown

Table 4: RJ 45 pin assignment color code

Cable adapter

To connect d&b devices (RJ 45 connectors) to CAN devices equipped with a CiA D-SUB 9 connector (e.g. like the PEAK CAN interfaces), we recommend using the d&b Z6117.000 D-SUB 9 F to 2 x RJ 45 F CAN adapter.

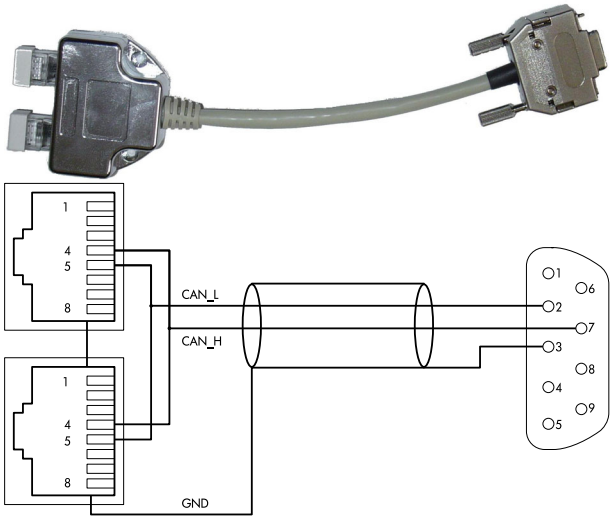


Fig. 7: Z6117.000 D-SUB 9 F to 2 x RJ 45 F CAN adapter

It is also possible to use a single adapter cable as shown in Fig. 8. A terminating resistor might be included, if this adapter cable is being used at the end of the bus.

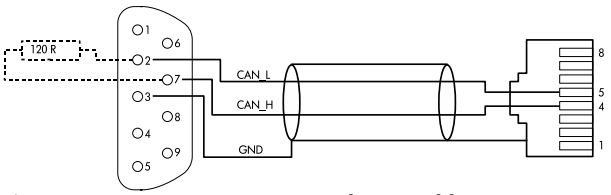


Fig. 8: D-SUB 9 F to RJ 45 M CAN adapter cable

If the CAN signal is transferred over a digital audio or DMX 512 cable with XLR connectors, the following adapter cables are required:

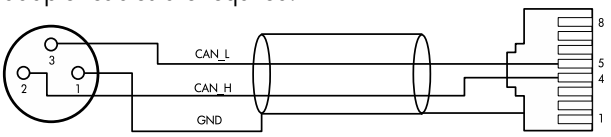


Fig. 9: XLR to RJ 45 M CAN adapter cable

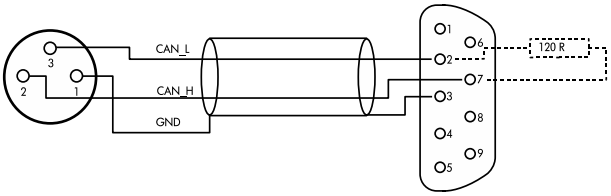


Fig. 10: XLR to D-SUB 9 F adapter cable

8. Termination of the CAN-Bus

The CAN-Bus has to be terminated on both ends using a resistor of 120 ohms. With d&b devices this can be done using the d&b Z6116.000 RJ 45 M Terminator.

Fig. 11: Z6116.000 RJ 45 M Terminator

The d&b R60/R70 CAN interface has a built-in switchable terminator which can be activated when only one of its CAN connectors is used.

9. CAN Devices and accessories

As the CAN-Bus is standardized in ISO 11898 there is a vast choice of CAN devices and accessories from different manufacturers.

When using a CAN repeater, make sure that it supports the baud rate of the CAN network (100 kBit/s). Use two d&b Z6117.000 D-SUB 9 F to 2 x RJ 45 F CAN adapters to connect it to the RJ 45 cabling - one for each bus segment.

10. CAN-Bus PC Interfaces

Two CAN interfaces are available from d&b. For installation details, refer to the respective manuals.

Up to five interfaces may be connected to a PC and simultaneously operated by the R1 software.

R60 USB to CAN interface

The Z6118 R60 USB to CAN interface provides two RJ 45 CAN connectors with a built-in switchable terminator as well as an USB type B connector and comes with drivers for Windows® operating systems. The required drivers for the R60 can be found in the R1 installation folder, e.g.: C:\program files\dbaudio\R60_D6_USB_DRIVER.

R70 Ethernet to CAN interface

The Z6124 R70 Ethernet to CAN interface provides two RJ 45 CAN connectors with a built-in switchable terminator as well as a LAN connector. The R70 contains a web interface and does not require its own drivers for use with a computer. All configurations can be set using a standard web browser with JavaScript enabled.

Additional interfaces

Important: Starting with R1 V3.16.x the PEAK CAN USB and PEAK CAN PCI interfaces are no longer supported due to the transition to a 64bit version of R1 for Windows.

Additionally, the following interfaces are supported by the d&b Remote network (driver for Windows® only):

- Peak USB to CAN interface (isolated, single CAN channel on D-SUB 9 connector). Only a single Peak USB interface may be connected. However, it may be combined with additional R60 or R70 interfaces.
- Peak PCI interface (isolated, single CAN channel on D-SUB 9 connector). Only a single Peak PCI interface may be installed. However, it may be combined with additional R60 or R70 interfaces.

11. CAN-Bus grounding

The PC interfaces recommended by d&b are optically isolated. The ground on d&b Remote network therefore is delivered by the amplifiers via the cable shield.

Please note that E-PAC amplifiers with serial numbers up to 3170 do not use and do not link through the CAN ground on their RJ 45 connectors, but instead have their internal interface optically isolated. To avoid grounding problems when these units are used in combination with D6/D12 amplifiers or E-PAC amplifiers from serial number 3171 (CAN ground = device ground), make sure that the first amplifier connected to the CAN PC interface is a D6/D12 or an E-PAC from serial number 3171 or higher.

12. dbCAN-ID

Every CAN node (amplifier) has a so-called dbCAN-ID for identification. It has to be set locally on the device and must be unique throughout the whole network. The dbCAN-ID consists of two values, the subnet (0...7) and the device ID (1...63) separated by a dot, e.g. 0.01 (subnet 0, device 1).

13. References

Further information about the CAN-Bus itself can be found in the following documents:

[ISO] ISO 11898 (1993-11) Road vehicles - Interchange of digital information - Controller Area Network (CAN) for high-speed communication.

[CiA] CAN in Automation Draft 303-1 - Cabling and Connector Pin Assignment

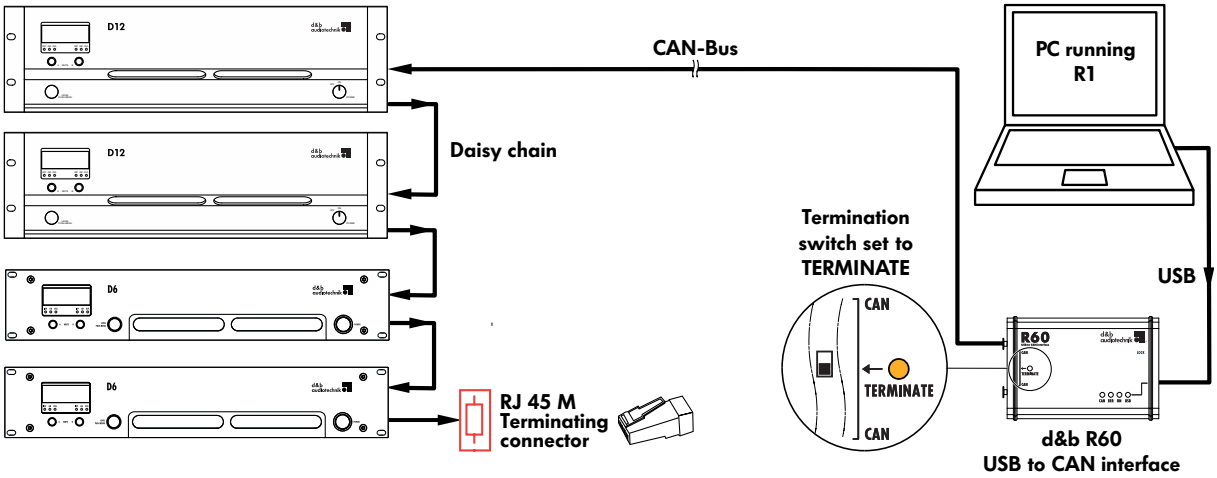
[CAN] CAN - Controller Area Network, Grundlagen und Praxis, Hüthig-Verlag, ISBN 3-7785-2575-3

[PCA] PCA 82C250 CAN Transceiver, Application Note, Phillips Semiconductors.

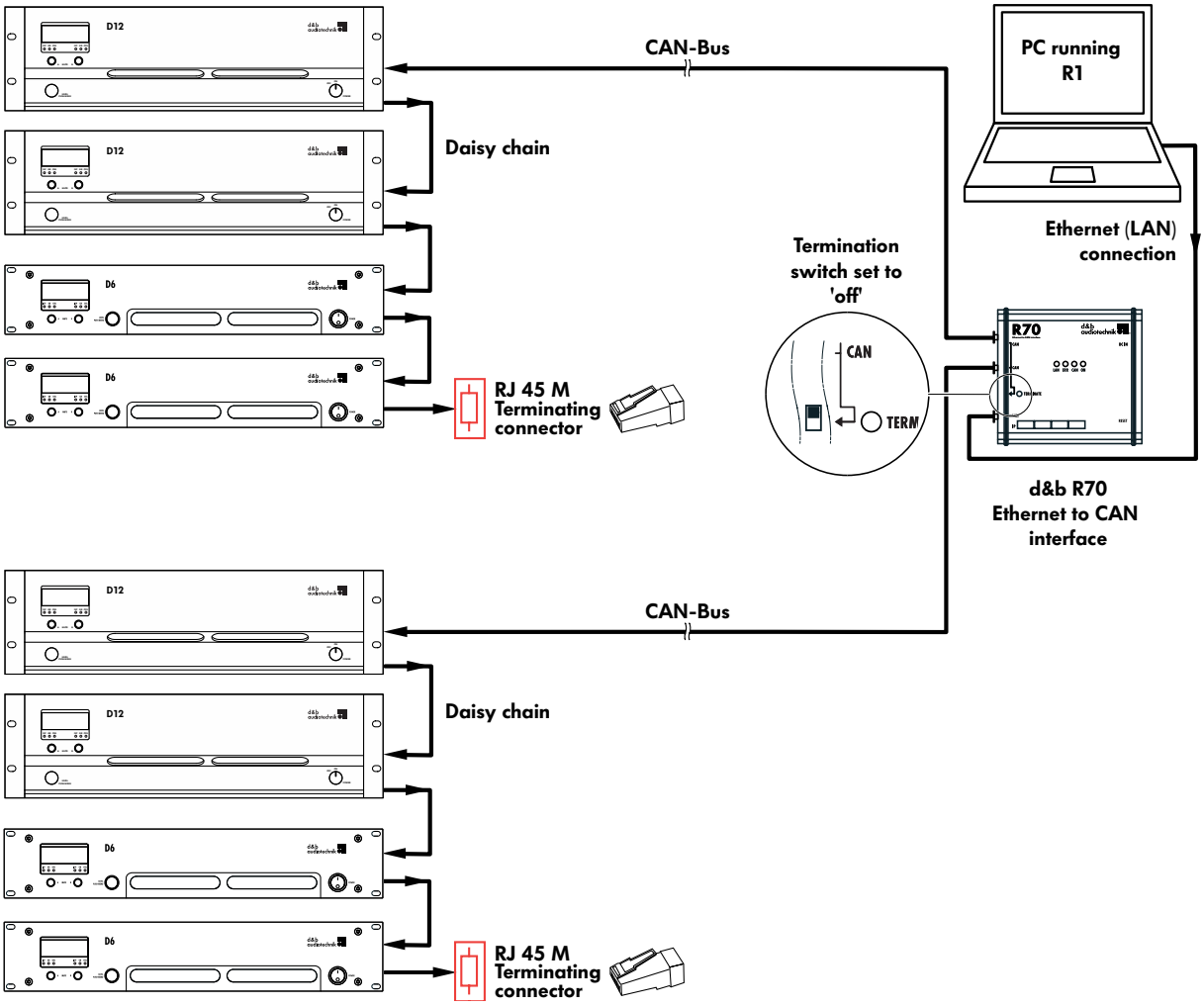
14. List of abbreviations

CAN:	Controller Area Network
ISO:	International Organization for Standardization
R1:	Remote control software by d&b audiotechnik GmbH
DeviceNet:	Field bus based on CAN (CENELEC EN 50325)
USB:	Universal Serial Bus
PCI:	Peripheral Component Interconnect
DMX512:	Digital Multiplex Signal up to 512 channels (DIN 56930-2)
AES/EBU:	Audio Engineering Society/European Broadcasting Union
CAT5 F/UTP:	Category 5 foil screened unshielded twisted pair
EIA/TIA-T568A/B	Commercial building telecommunications cabling standard

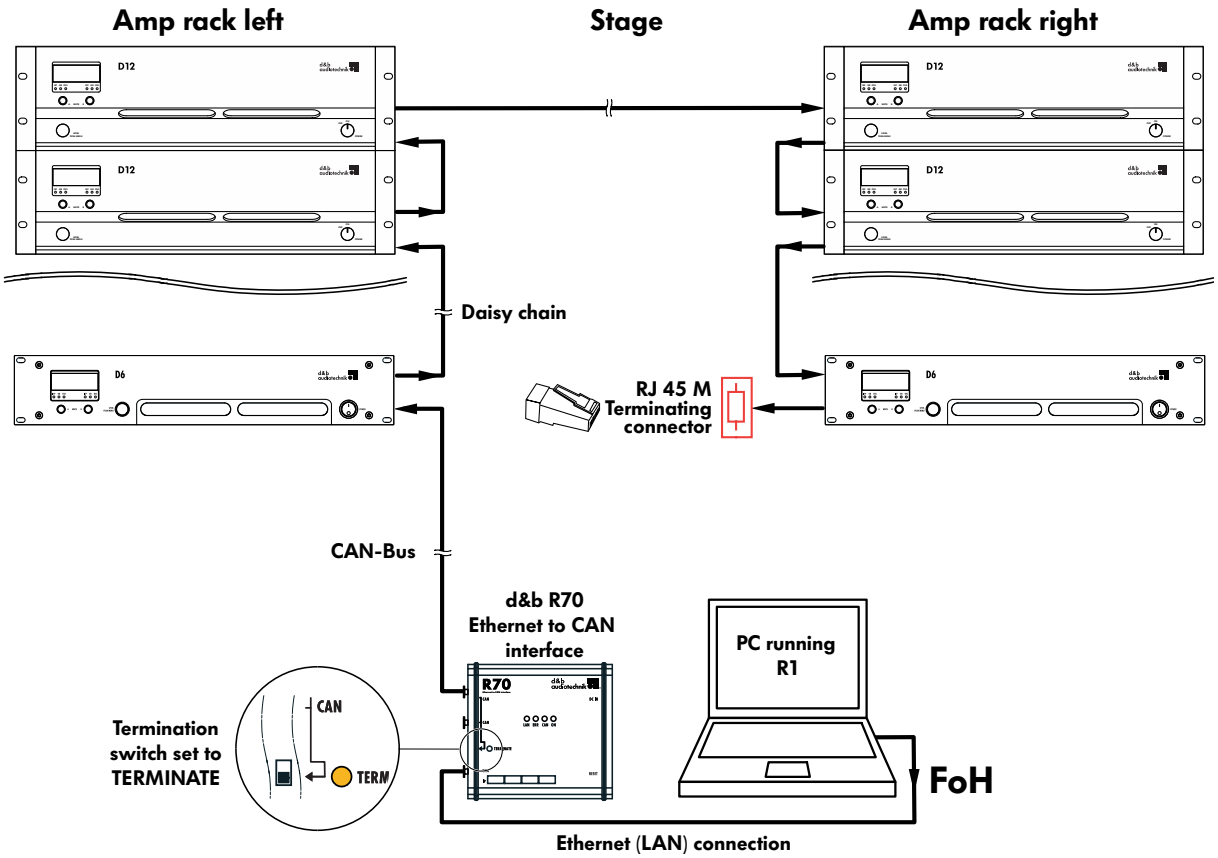
15. Application examples



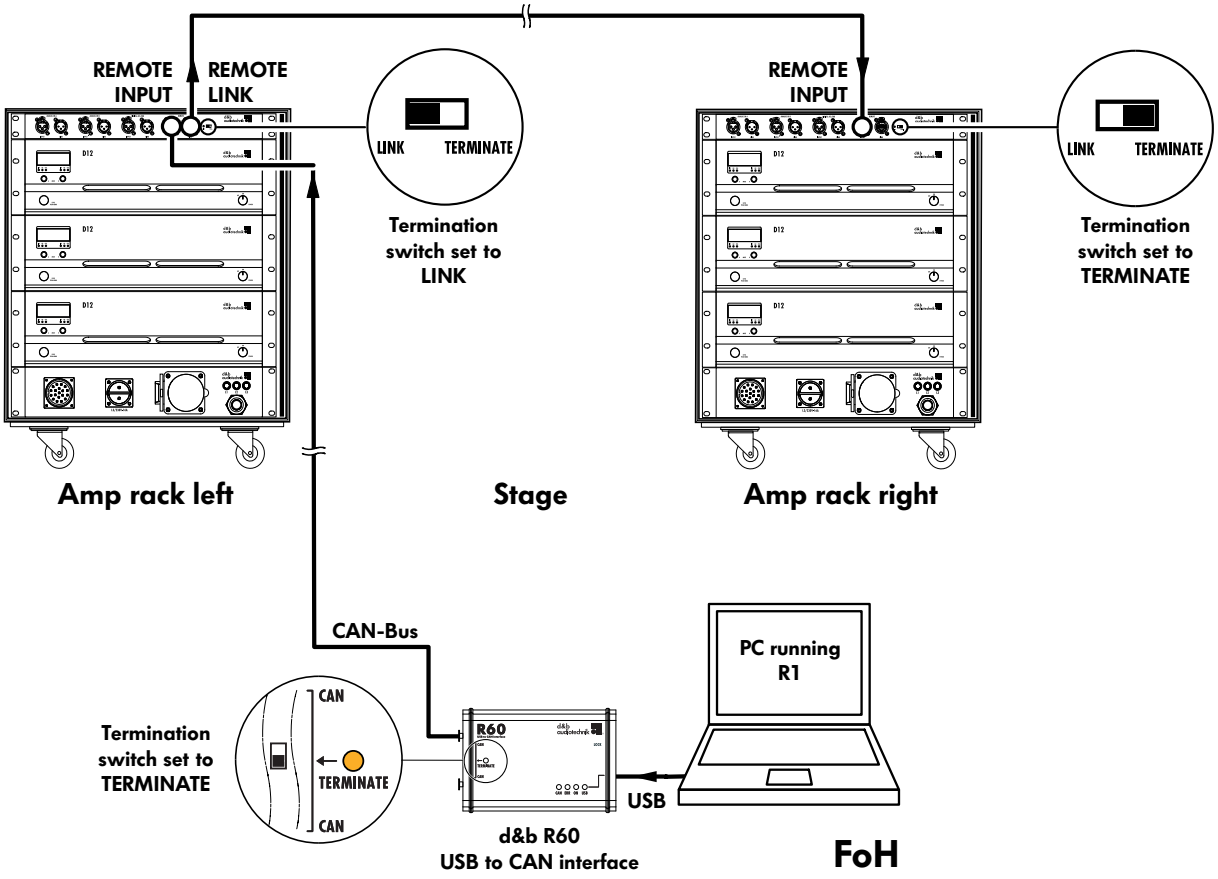
Example 1: Simple setup with terminated interface at the "beginning" of the CAN-Bus segment.



Example 2: Wiring example with non terminated interface within the CAN-Bus segment.



Example 3: Typical stereo set up with PC control from FoH



Example 4: Same as example 3 shown with Z5310 Touring rack assembly and setting of the termination switches of the I/O panels. (Z5313)