x1Designer

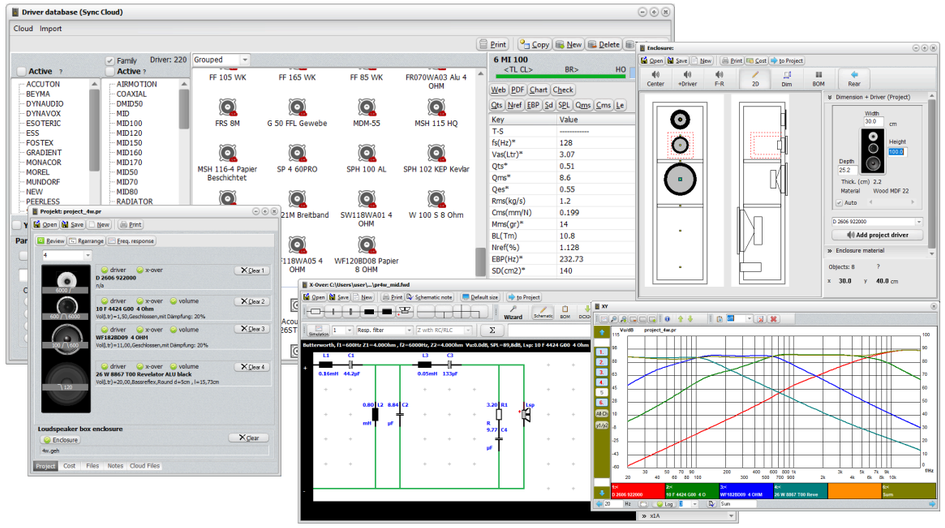
Loudspeaker box construction

x1Des-EN 202345A

STUTE Engineering

1 x1Designer

Easily design top speaker cabinets yourself: Calculation, Simulation, Design.



Steps to your own box:

1. determine the number of ways of the box
2. select loudspeaker from database
3. calculate volume
4. design crossover with the wizard
5. define cabinet size and place loudspeakers
6. check costs
7. set up cabinet and enjoy music with your own sound design

x1Designer Highlights:

- Project module shows the open design tasks
- Less inputs: Automatic T-S data (Vas, Qts…) transfer into modules for calculation
- Over 200 pre-installed driver
- Quick import of additional loudspeakers via the freely accessible loudspeaker database https://loudspeakerdatabase.com (more than 3000 speakers)
- Easy manual speaker & component input
- Synchronization of databases across multiple PCs (free cloud)
- Share design files (cabinet, crossover, project) via cloud
- Always everything in view: Scalable screens & multi-window design
- Enclosure: Place loudspeakers on front and back of enclosure
- Real conditions: Simulation of the crossover taking into account the nonlinear impedance of the loudspeaker
- Real components: Replace calculated component values with market ones and show and correct influence via simulation
- Optimize frequency response with the EQ function

- Acoustic pre-test of the passive crossover
- Import frequency response measurement from Audio Analyzer x1Analyzer
- Import Thiele Small Parameter measurement from x1Analyzer
- Powerful simulation display, up to 6 diagrams simultaneously
- Print output, Parts list output
- And much more...

1.1 Update

Via the update icon, MS-Windows Start menu / Apps, you update the software to the latest version.

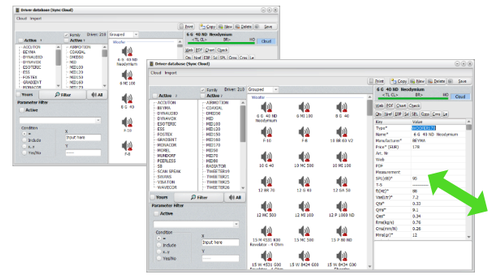
1.2 Expert vs. Pro Version

The following functions are not available in the "x1Designer Expert" version:

- Frequency response correction "EQ
- Export crossover to Audio DSP DCX2496 (Acoustic Pre-Test)
- Share design files via cloud (project, cabinet, crossover)

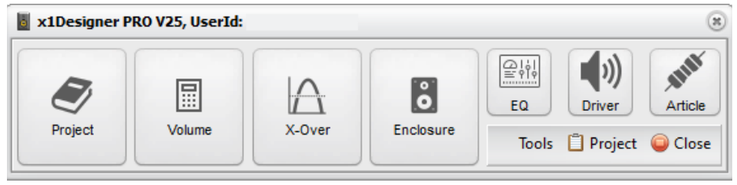
1.3 Adjust module size

Some modules can be adjusted in size.



2 Program

2.1 Module „Home“



Module	Description
Project	Shows details of the ways of the speaker box as well as the cost calculation. Access to the design files from the cloud is also from here.
Volume	Calculation of the housing volume incl. simulation
X-Over	Crossover calculation including simulation
Enclosure	Enclosure-Designer
EQ	Optimization of the acoustic frequency response via Equalizer
Driver	Driver-Database
Article	Article-Database (components for crossover, housing material)

You call a module by clicking on an icon.

Other functions:

- Project: Close all screens, except „Home“ and „Project“
- Close: Quit program
- Tools: Menu with additional functions

Tools	Description
Setup	Display the setup
Web	Display product homepage
Manual	Display latest PDF manual from web
Info	Display program version

2.2 Module “Project”

The "Project" module is the center for the design. Here you select the number of paths, determine the loudspeaker, crossover and volume and start with the cabinet design. **The red and green icons respectively lead to the tasks that are still open**. It is divided as follows:

Tab	Description
Project	Select driver qty. Display details to each driver: volume size, cut-off ... The numbers above the speakers in the graph shows the cutoff frequency of the assigned crossover.
Cost	Display costs (Driver, X-Over, Enclosure)
Files	Link to EQ setup, measurement and default for project files
Note	Notes to project
Cloud Files	Share design files (Enclosure, X-Over, project) via cloud with additional PCs

2.2.1 Tab „Project“

Button	Description
Review	Check the project. What is missed?
Rearrange	Delete empty driver and sort via driver diameter size
Freq.-response	Shows the sum frequency response (simulation crossovers) in phase over all paths

Chassis 1..5	Description
Driver	The "Loudspeaker database" module opens. Select the loudspeaker here and transfer the selection here using the "Transfer" button in the "Loudspeaker database" module. Right-mouse click clears entry
X-Over	The "Crossover design" module opens. Use the wizard to create a crossover, save it and transfer it to the project via the "Transfer" button from the "Crossover Design" module. Right-mouse click clears entry
Volume	The "Volume calculation" module opens. Select the volume type and start the calculation. Transfer the result to the project with the "Transfer" button from the "Volume calculation". Is not displayed for some chassis types, such as tweeters, because a calculation is not required. Right-mouse click clears entry
Clear	Delete chassis, crossover and volume

Loudspeaker box enclosure	Description
Enclosure	A) File exists: Module "Enclosure“ opens and displays the enclosure. B) File not exists: Module "Enclosure“ opens. Create a new enclosure, place the driver. Finally save it. Use the "to Project" button from the "Enclosure" module to transfer the housing to the "Project" module.
Clear	Clear link from project to enclosure file

2.2.2 Tab „Cost“

The page shows the costs from all speakers, crossover components as well as the cabinet (e.g. all MDF panels). The individual prices are stored in the databases. Via the button "Update" the calculation is updated after changes.

2.2.3 Tab „Files“

- Project directory : Select folder for file storage. Applies to the file type Project, Crossover, Cabinet, EQ. Overwrites the defaults from the setup!
- EQ settings: Add EQ file to project
- Measurement: Save measurement to project

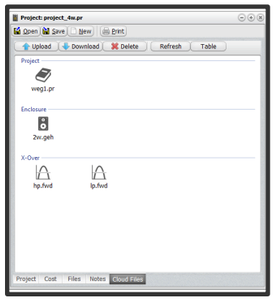
Button	Description „project folder“ , „EQ settings“, „Measuring“
New	Select File or path
Clear	Clear entry
View	Path: View in file explorer File EQ: Display setup in EQ module File Measuring: Display file with measuring software (see Setup)

2.2.4 Tab „Notes“

Input from notes to the project.

2.2.5 Tab „Cloud Dateien“

Here you can share crossover, enclosure and project files via cloud in the team or a second PC.

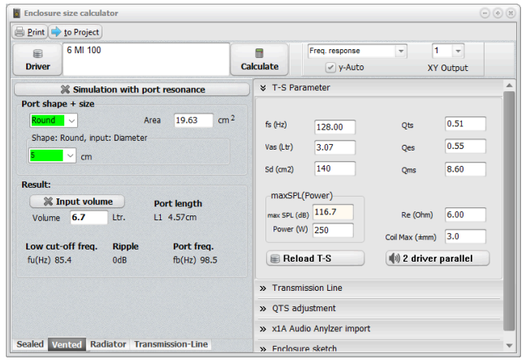


Button	Description
Upload	Upload file to cloud
Download	Download file from cloud
Delete	Delete file in cloud
Refresh	Re-load files
Table	Change view (Icon <-> Table)

2.2.6 Header menu

Button (header)	Description
Open	Open project
Save	Save project
New	Clear all project entries
Print	Print project details

2.3 Module „Volume“



The calculation / simulation of the volume is very simple and fast: select the loudspeaker, choose the enclosure type and click on "Calculate". Done! The input of the required T-S data is done automatically from the database.

The following types are available:

- Sealed (Closed)
- Vented (Bass reflex)
- Passive diaphragm
- Transmission Line

2.3.1 Basics

2.3.1.1 Select loudspeaker & start calculation / simulation

Button	Description
Driver	**Option 1: Adopt loudspeaker from project** Click on "Volume" of the appropriate loudspeaker in the "Project" module. The T-S parameters are taken over from the database. **Option 2: Select loudspeaker from database (without project)** Click on "Chassis", the loudspeaker database opens. Select a loudspeaker and confirm the transfer with the "Transfer" button in the database. The T-S parameters are taken over from the database. **Option 3: Manual input (loudspeaker not in database)** Enter all shown Thiele Small parameters, except "maxSPL"
Calculate	Calculate volume and show simulation. Select appropriate simulation type (frequency response, impulse response..) in the header. See also "Customize simulation" below

2.3.1.2 Feld „T-S Parameter“

Thiele Small Parameters for Simulation & Calculation:

	Description
fs	Free air resonant frequency in Hz
Vas	Equivalent volume in liters
Sd	Effective diaphragm area in cm2
Qts	Total Q factor
Qes	Electrical factor
Qms	Mechanical factor
Power	Continuous power in watts. Tip: Change the value to simulate e.g. the membrane excursion for other powers
Re	DC resistance of the loudspeaker

	Description
Col lin	Maximum or max. linear diaphragm deflection in ±mm. The label in front of the field shows which value was taken from the database
max SPL	Max SPL (sound pressure level) is calculated as part of the cabinet simulation. Value depending on Power (W)
Button “Reload T-S”	Read Thiele-Small parameters for the shown loudspeaker again from the driver database
Button “2 driver parallel”	Calculation and simulation for 2 similar loudspeakers in one cabinet. The loudspeakers are connected in parallel: Plus connected to plus and minus connected to minus

2.3.1.3 Qts adjustment

Resistors in series to the loudspeaker change the Qts of the loudspeaker, e.g. cable or coil of the crossover and thus have influence on the calculation. This is taken into account via the input here.

	Description
Active	Adjustment on/off
Rg	DC Resistor in front of the driver in Ohm
Note	Notes to the adjustment (Output to print)

2.3.1.4 Customize simulation

Simulation	Description
Select type: Frequ.-response , Impulse response...	Select the desired simulation via the selection in the header. The selection varies depending on the volume type. The available simulations are mentioned in the chapters on the housing types. Then press "Calculate"
y-Auto	Set scaling of y axis in XY window automatically
XY Output	Write simulation to channel x of the XY screen. x = 1..6

Note 1: The "Cone excursion“ simulation is based on the "Power" value in the "T-S Parameter" field. To display the excursion for a different power, change "Power" and press the "Calculate" button again.
Note 2: Transmission line cannot be simulated.

2.3.2 Import measuring

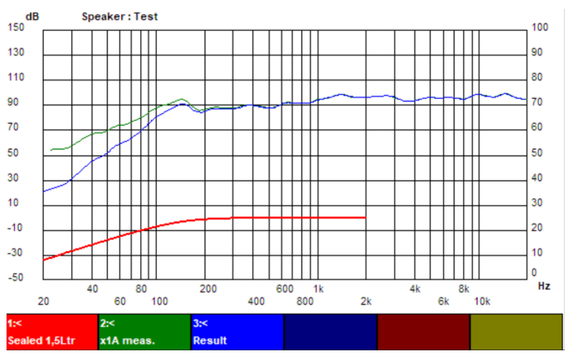
It is possible to import an acoustic measurement from the x1Analyzer (optional software) and overlay it with the simulation result "Frequency response". As a result you get the frequency response in the installed state.

With the button "Import from XY channel" from the field "x1A Audio Analyzer Import" you can combine a frequency response measurement with the simulation of the frequency response.

- Open the Audio Analyzer x1Analyzer program.
  - Open an acoustic measurement or use the last measurement
- Program x1Designer
  - Select an enclosure type, e.g. "Sealed".
  - Start the simulation of the frequency response, "Calculate" button
  - Set the "XY" channel of the import function to the channel of the XY window of the program x1A with the relevant trace: E.g. x1A: Measurement in xy channel 1 => set "XY" in x1Designer to 1
  - Press the "Import from XY channel" button

- The XY window of x1Designer shows (channels fixed):
  - the simulated frequency response in channel 1
  - the imported measurement in channel 2
  - and the result/sum in channel 3.

Note: The "XY" channel from the x1Designer header is ignored.



2.3.2.1 Function

Button (Header)	Description
Print	Print the result of the calculation and simulation
To Project	Transfer volume to the "Project" module. See "Project" module button "Volume"

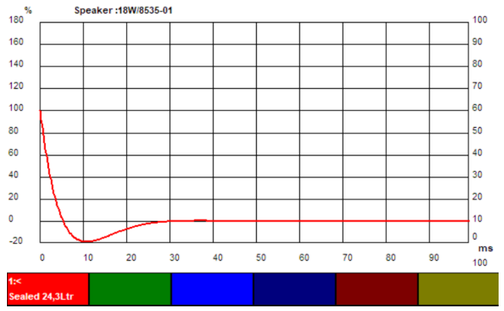
2.3.3 Enclosure „Sealed“

Value	Description
Calculation based on	Default for calculation. Please select. The selected one lights up green: **Q total**: Quality of the system consisting of loudspeaker & cabinet. **Vn**: Volume size in liters for the construction (damping material increases the volume) **fr**: resonance frequency in Hz in installed condition
Q total	Input Q total factor of the system consisting of loudspeaker & cabinet (standard 0.707: good compromise between impulse response and frequency response)
Damping	Damping material increases the volume given by the housing. The influence is configured here: Active: Set, influence by damping material is taken into account. Percentage value: The more material is used, the more the volume increases. 20% is the default. Vol. with damping: Effective volume from housing size and damping material
Result	**Default Q total:** Volume Vn: Volume in liters for the cabinet construction and the resonant frequency fr of the loudspeaker when installed in Hertz. **Default Vn:** Q total and the resonant frequency fr of the loudspeaker when installed in Hertz **Default fr:** Q total and the volume Vn in liters

2.3.3.1 Simulation

Type	Description
Freq.- response	Shows the frequency response of an ideal loudspeaker in the cabinet
Impulse response	Displays the impulse response
Cone excursion	Shows the membrane excursion over the frequency to the power "Power". The "maxSPL" field shows the appropriate sound level. The max. or max. linear excursion is also shown in the XY window (line in magenta). Change the power "Power" to simulate the excursion e.g. for 1 Watt.

Example impulse response



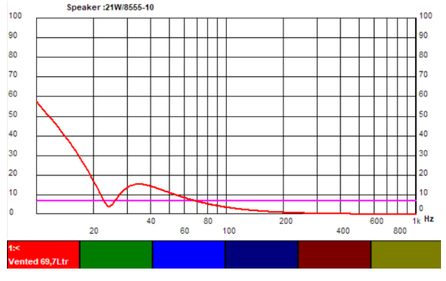
2.3.4 Enclosure „Vented“

Value	Description
Port shape + size	Bass reflex shape and size Round: Round tube, enter diameter in cm. The area is calculated automatically. Square: Rectangular duct, enter width and height in cm. The area is calculated automatically. Area: Input the area of the channel. Diameter or HxW are not interested
Result	Button “Input volume" pressed: Enter volume in liters yourself instead of calculating. - Volume: Output "Volume" in liters (Button "Input volume" not pressed) or input (key pressed) - Length: Channel length in cm - Ripple: Deviation in dB in the range before the channel frequency (>fb) - Channel frequency fb: From here on, the frequency response tends to drop sharply in the direction of 20 Hz - Lower cutoff frequency fu: Frequency response reaches -3dB from maximum before channel frequency (>fb)

Simulation

Type	Description
Freq.-response	Shows the frequency response of the cabinet type. Tip: Can be overlaid with the loudspeaker measurement from x1Analyzer.
Impulse response	Displays the impulse response
Cone excursion	Shows the diaphragm excursion versus frequency to power from the T-S parameter field "Power". The "maxSPL" field shows the appropriate sound level. The max. or max. linear displacement is also shown in the XY diagram. Tip: Change the power "Power" to simulate the excursion e.g. for 1 Watt.
Air speed port	Shows the air velocity in the bass reflex (measure of air-regenerated noise) over the frequency. The recommendation for the max. speed is shown in the XY diagram.

Example of diaphragm deflection at maximum power. Result can also be simulated for low power. Pink: Max. lin. voice coil excursion from the chassis database.



2.3.5 Enclosure „Radiator“

For this type of enclosure, you select the "Active" and "Passive" chassis and then simulate the result. Use the simulation result shown to determine the optimal enclosure size.

Follow steps 1 to 3 to start the simulation:

Steps	Description
1: Select Woofer	**Option 1: Take over woofer from the project** Click on "Volume" of the appropriate loudspeaker in the "Project" module **Option 2: Select woofer directly from the database** Press the "Chassis" button. Select a woofer from the database. Transfer the woofer from the database using the "Take over" button
2: Select Radiator	**Option 1: Take over passive membrane from project** Press the "From project" button. The speaker of the "Radiator" type from the project is taken over. Option 2: Select passive membrane from database Press the "from driver DB" button. Select a passive diaphragm from the database (type = Radiator). Transfer the membrane from the database with the "Take over" button
3: Input Volume	Enter the desired volume for the woofer with passive cone in the "Vol" field in liters. Option: Is a larger or smaller cabinet better? Set "Result for Vol". The program simulates in one pass for the desired volume as well as for the adjustments ±x liters around the target volume. E.g. target volume = 20 liters and as result for Vol. set ± 4 liters => For 20 liters = result in XY channel 3. channel 2= 16 liters (- 4 liters) and channel 4 = 24 liters (+ 4 liters) etc.

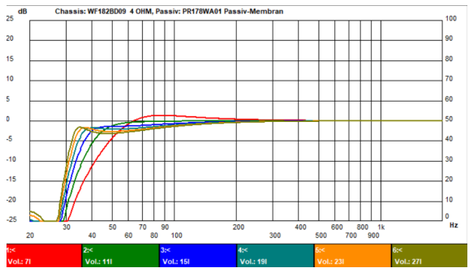
Then press the "Calculate" button to start the simulation!

For the simulation, Thiele required Small parameters of the passive membrane:

- fsp: resonant frequency in Hz
- Mmp: Moving mass in grams
- Qmp: Mechanical quality
- Sdp: Effective diaphragm area in cm2
- Xpmax: Maximum excursion of the membrane in ±mm

Note: Parameters are taken from the database.

Show frequency response with passive diaphragm for target volume 15 liters (blue) and for volume change ±4 liters (7,11,15,19,23,27 liters). Determine the optimal volume.



2.3.6 Enclosure „Transmission-Line“

To calculate the channel, enter the tunnel frequency fs in Hz and press the "Calculate" button. The T-S data as well as the loudspeaker dimensions to the loudspeaker are taken from the database. Further parameters for the calculation can be found in the selection "Transmission Line" on the right.

Result

Result	Describe
L1	Free space behind the loudspeaker in cm (depth and area, transmission line start)
L2	Dimensions of the transmission line outlet in cm (area in cm2)
Min. Enclosure depth	Depth of the speaker box due to the channel geometry in cm
Line length	Transmission Line Length in meters

Tip: For an explanation of L1 and L2, call up the housing sketch on the right.

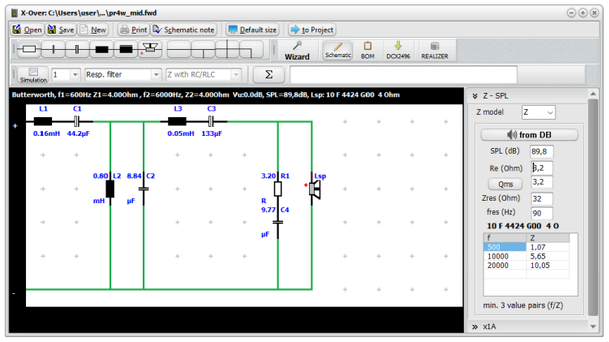
Optional parameter

	Description
Driver width	Outer dimensions (e.g. diameter) of the loudspeaker from the loudspeaker database
Encl. Material thickness	Housing material thickness outside in mm, such as MDF 22mm
Button “Calculator”	Click calculates the required minimum enclosure width from the previous values (enclosure material & chassis width)
RF and Vortex	Preset parameters for calculation. Should only be changed by expert knowledge

Note: The simulation is not possible. Transfer to the project is not possible.

2.4 Module „X-Over“

With the module you can easily calculate your crossover, a voltage divider or the impedance correction (RC/RLC) via the wizard. The wizard takes the required parameters from the loudspeaker database or the Z model. Of course, the parts list output as well as the cost calculation via the article database is also implemented.



2.4.1 Convert mathematical component values into REAL ones

The mathematically calculated component values of the crossover can hardly be purchased. Real component values are only available in a certain value grid, which always challenges the developer: Cost-effectively purchase the closest value and accept the deviation? And what are the effects on the behaviour of my crossover?

The REALizer supports you in the transition from the mathematical to the real component. It searches for suitable components from the article database and suggests them. The goal is to find a replacement from max. 3 components whose sum value is within the tolerance of +- 5% (e.g. 7.5mH = 4.7mH + 2.2mH + 0.47mH). x1Designer also considers in the simulation the addition of the DC resistors by the coils.

The design over real components can be found in the parts list view. Here the calculated value as well as the alternative from REAL components is shown, column "Note". The value in % shows the deviation to the mathematically calculated values.

Sample *CE3.1=100,0 | CE3.2=33,0 | =133,0µF (0,3% / 132,63µF)

C3 = 132.63µF calculated value, replaced by C3.1 = 100µF and C3.2 = 33µF = 133µF. Deviation 0.3%

2.4.2 Function

2.4.2.1 Icons „Module“

Button	Description
Open	Open filter
Save	Save filter
New	Clear filter
Print	Print schematic, BOM or simulation
Schematic note	Input filter notes (headline of schematic)
Default size	Scale screen to 100%
To Project	Transfer to filter to module “Project”. Please save first the design as a file!

2.4.2.2 Icons „Function“

Button	Description
Wizard	Crossover design wizard
Schematic	Display Schematic
BOM	Display Bill of material (BOM)
DCX2496	Transfer filter to Behringer DSP DCX2496 (acoustical Pre-Check)
REALIZER	Replace calculated part values with real parts from the parts database. Details in BOM view

2.4.2.3 Icons „Component“

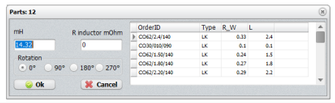
Component	Description
	Resistor
	Capacitor
	Electrolytic capacitor
	Inductance / air coil
	Inductance / coil with core, such as ferrite
	Speaker. Polarity can be changed via the popup menu
	Connection straight
	Connection T piece
	Crossing
	Connection 90° angle

2.4.2.4 Icons „Simulation“

Function	Description
Simulation	Display simulation
1	Select output channel 1..6 for simulation in XY screen
Resp. filter	Selection of the simulation type "Frequency response" or "Impedance": **Resp filter:** Shows the frequency response considering the selected impedance type "R" or "Z". **Z Impedance:** Shows the impedance to the impedance type of the chassis. See below "Z with RC/RLC
Z with RC/RLC	Only simulation type "Z Impedance": **Z with RC/RLC:** Shows the impedance considering the correction by RC and/or RLC. **Z only driver:** Shows the impedance of the loudspeaker. Ideal for checking the impedance type "Z", simulation of the chassis impedance.
Sum ∑	Show the sum frequency response from all crossovers of the current project
CE3.1=...	Info line, shows details about the component

2.4.2.5 Popup Menu

The popup menu shows special functions for the selected part. A component is selected when the cursor is positioned over the component. The popup menu is opened by right-clicking the mouse button:

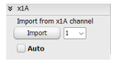
Function	Description
Clear	Remove component / connection
Cut	Cut component / connection
Paste	Paste component / connection
Rotate	Rotate component / connection 90° to right
Change value	Change component value: Manual input or part selection from the part database, matching the type from the schematic: Component type "L" => selection shows only components of type "L 
Change type	Replace capacitor with electrolytic capacitor or air core coil with core coil.
Add driver	Add chassis
Change driver phase	Change phase / polarity of the driverr (influence on the simulation)

2.4.2.6 Driver Z Model

The impedance of the loudspeakers is in most cases not linear 4 or 8 Ohm. x1Designer allows you to simulate the frequency response taking into account the non-linear impedance, showing the changes in the transmission behavior.

Button	Description
..from DB	Copy the Thiele Small parameters incl. the SPL for the selected loudspeaker from the loudspeaker database
Z Model	Selection of Z model for simulation: R: Resistance (simple model). Impedance constant over frequency Z: Complex model with impedance peak at free air resonance and impedance rise to high frequencies (R+L in series with parallel resonant circuit. (R||L||C)
Parameter	Z Model "R": Nominal impedance in ohms from the database, e.g. 4 or 8 ohms. Value constant over frequency. Z Model "Z": Non-linear impedance: resonance peak as well as rise to high frequencies. **"SPL" to "fres" are taken from the database:** - **SPL:** Sound pressure level 2.83V - **Re:** DC Resistor in Ohm - **Qms:** Mechanical Q factor. Can be calculated via the button “Qms” - **Zres:** - Impedance value to resonant frequency: ideal when installed, alternative to free-air resonant frequency. - **Table (f/Z):** • Note: Please leave the value for 500 Hz unchanged. • Determine the impedance value for 10kHz and 20kHz from the manufacturer's data sheet of the chassis. Enter the values in the table. • Check the simulated impedance curve with the one from the data sheet. Select the simulation type= "Impedance Z" and "Z only driver". Press the "Simulation" key. The XY window shows the impedance curve.

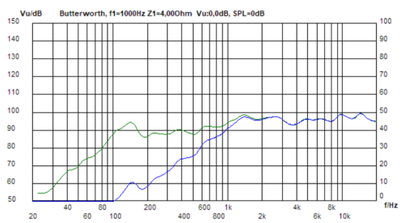
2.4.3 Combining simulation & measurement



- Start the optional x1Analyzer program
  - Open an acoustic measurement or use the last measurement
- x1Designer
  - Create the crossover with the wizard or open an existing one
  - Set the XY channel of the import function to the channel of the xy window of x1Analyzer that contains the trace: E.g. x1Analyzer measurement in xy channel 1: set the channel "XY" in x1Designer to 1.
  - Press the "Import" button
  - The XY window of x1Designer shows
    - the simulated frequency response in channel 1
    - the imported measurement in channel 2
    - and the result in channel 3

Tip: Activate "Auto" to display the overlay from simulation and import after each simulation result.

Ex. green: measurement loudspeaker without filter, blue: measurement combined with filter



2.4.4 Filter Wizard

The wizard creates the circuit diagrams of the crossover according to your specifications (filter type, cutoff frequency...) and starts the simulation. Impedance and Thiele Small parameters are read from the loudspeaker database.

2.4.4.1 Tab “Filter”

	Description
Function	Filter type: Butterworth, Bessel, Chebyshev 0.1db, 0.5, 1.0dB, Linkwitz-Riley (LR)
Type	Filter type: Tweeter, Woofer, Mid-Range
Slope	1..4 order / 6dB..24dB/octave (slope of the filters), Linkwitz-Riley only 2nd and 4th order
fg	Filter type tweeter / bass: Input of cut-off frequency in Hz
Lower / Upper	Filter type mid-range: Input lower and upper cutoff frequency in Hz

2.4.4.2 Tab “Z” (Impedanz)

	Description
Z	Input of impedance to frequency fg (filter type tweeter or bass)
Z lower / Z upper	Impedance to upper cut-off frequency f2 (mid-range only)
Button „Read from model“	Read the impedance values from the Z model ("R" or "Z"). The text in brackets <x> indicates the selected model. **Note: If “EQ Z” is enabled, like “RC”, the impedance is read from the corrected impedance chart**

2.4.4.3 Tab “-x DB” (Voltage divider)

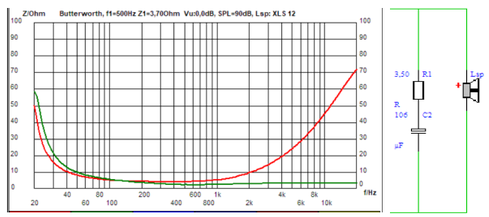
	Description
enable	Selected: Calculate voltage divider and add to circuit diagram
dB	Attenuation in dB. Tip: Take attenuation from the database, data sheets or measurement. A simple calculation is possible via the SPL specification. Speaker A: SPL 92dB Speaker B: 86dB => Attenuation for speaker A by -6dB. Note: Do not attenuate woofers!

2.4.4.4 Tab “EQ Z” (Impedance correction)

	Beschreibung
Type	- : Crossover without correction RC (Z): Crossover with a Z-correction for the impedance rise to the high frequencies (RC element) RC (Z)+RLC (fr): Correction for impedance rise to high frequencies and impedance peak at resonant frequency. Tip: Should only be used when the cutoff frequency of a bandpass (mid-range crossover) is close to the resonant frequency.
Button “Read driver values”	Re, Le read from the speaker database. If "Free Air Parameter" is selected, fmc, Qmc, Qec will be filled with the free air values from the data
	Parameters for RC(Z) - correction of inductive Z rise to high frequencies
Re	DC resistance of the voice coil in ohms
Le	Inductance of the voice coil in mH
	Parameters for RLC(fr) - correction Z peak at resonance frequency
fmc	Resonant frequency of the loudspeaker in installed condition (alternatively the free air value)
Qmc	Mechanical Q factor of the loudspeaker in installed condition (alternatively the free air value)
Qec	Electrical Q factor in installed condition (alternatively the free air value)
“Free air parameter”	Alternatively, use the free air values (fmc, Qec,...) of the loudspeaker if no data is available for the installed condition.

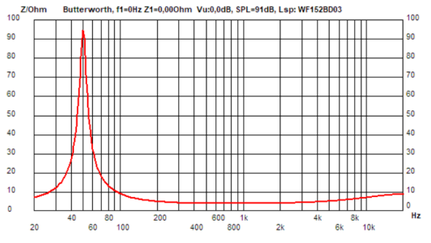
2.4.4.5 Sample RC Impedance correction

Simulation Red: without Z correction, Green: with RC correction

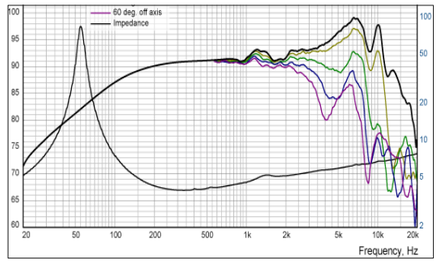


2.4.4.6 Comparison Z Simulation & Z Data Sheet

Simulation, Z values axis left



Z values manufacturer data sheet (axis right)



2.4.5 Transferring the crossover to the DCX2496

With this function you can test your crossover acoustically with the audio processor Behringer DCX2496 before you buy the expensive components of the passive crossover.

For the transfer into the Behringer DCX2496 you need the optional software DCX.Server & DCX.Client. The DCX.Client must be run on the computer running x1Designer. On the DCX2496 "Output Configuration" must be set to "Mono". The setup for the test can be found on the following pages.

Button	Description
Read all x-over...	Read in the crossover files from the project. x1Designer determines the appropriate DCX2496 setup and displays this in the "DCX2496 Setup" rectangle.
Transmit to DCX2496 ...	Transfer the crossovers to the Behringer DCX2496.

2.4.5.1 Preparation

- Connect the DCX2496 via RS232 interface (e.g. USB-RS232) to the PC running the DCX.Server program.
- Start the DCX.Server software
  - Start the DCX.Client MS-Windows on the same PC. x1Designer is also installed here
  - Press the "Connect" button on the DCX.Client.
  - Switch off the power amplifiers
- Connect the DCX2496 audio outputs to the audio power amplifiers and the DCX2496 inputs to the pre-amplifier output

2.4.5.2 Steps

- Open an x1Designer project file. Crossovers must be included
- Click on the button "Read all crossovers from project".
- The textbox "DCX2496 Info" and "DCX2496 Setup" shows the needed DCX2496 configuration and the details of the crossovers per way (order, cutoff frequency,..)
- Press "Transfer to DCX2496" to transfer the crossovers

2.4.5.3 DCX2496: Supported properties

The following parameters can be transferred to the digital audio process Behringer DCX2496:

- Filter: Butterworth, Bessel, Linkwitz-Riley
- Filter type: High-pass, Low-pass, Band-pass
- Filter slope: 6, 12,18, 24dB/Octave
- Cut-off frequency in Hz
- Damping (voltage divider) , z.B. -4dB
- Electr. polarity at the loudspeaker (0°, 180°)

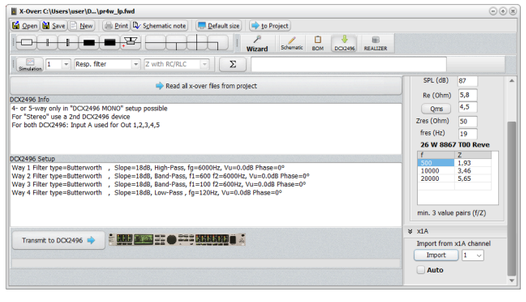
Not supported:

- Tschebyscheff-Filter

2.4.5.4 DCX2496 I/O configuration

Generally the crossovers are assigned to each way "Way 1,2,3.." of the speaker cabinet to a DCX2496 output. The following table shows the standard assignment for the outputs and inputs:

x-Way driver table	Description
1	Loudspeaker box left DCX2496 Input A = Input channel left, signal from pre-amplifier DCX2496 Out 1: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” Loudspeaker box right DCX2496 Input B = Input channel right, signal from pre-amplifier DCX2496 Out 4: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1”
2	Left DCX2496 Input A = Input channel left, signal from pre-amplifier DCX2496 Out 1: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” DCX2496 Out 2: Output, signal filtered according to audio crossover data from the x1D project table row “Way 2” Right DCX2496 Input B = Input channel right, signal from pre-amplifier DCX2496 Out 4: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” DCX2496 Out 5: Output, signal filtered according to audio crossover data from the x1D project table row “Way 2”
3	Left DCX2496 Input A = Input channel left, signal from pre-amplifier DCX2496 Out 1: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” DCX2496 Out 2: Output, signal filtered according to audio crossover data from the x1D project table row “Way 2” DCX2496 Out 3: Output, signal filtered according to audio crossover data from the x1D project table row “Way 3” Right DCX2496 Input B = Input channel right, signal from pre-amplifier DCX2496 Out 4: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” DCX2496 Out 5: Output, signal filtered according to audio crossover data from the x1D project table row “Way 2” DCX2496 Out 6: Output, signal filtered according to audio crossover data from the x1D project table row “Way 3”
4+	Note: A 2nd DCX2496 device is needed. One for channel left and one for channel right Setup for each DCX2496 device DCX2496 Input A = Input, channel right or left, signal from pre-amplifier DCX2496 Out 1: Output, signal filtered according to audio crossover data from the x1D project table row “Way 1” DCX2496 Out 2: Output, signal filtered according to audio crossover data from the x1D project table row “Way 2” DCX2496 Out 3: Output, signal filtered according to audio crossover data from the x1D project table row “Way 3” *DCX2496 Out 4:* Output, signal filtered according to audio crossover data from the x1D project table row “Way 4” *DCX2496 Out 5:* Output, signal filtered according to audio crossover data from the x1D project table row “Way 5”

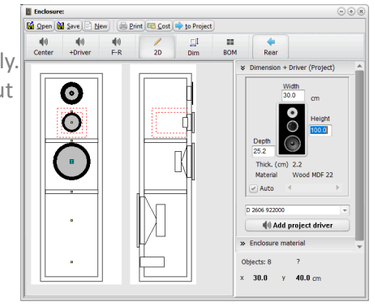


2.4.5.5 Setup "2 way loudspeaker cabinet

- Crossovers according to project view Way 1 (tweeter) and 2 (woofer)
- Out 2/5: woofer
- Out 1/4: tweeter

Note: For a proper transfer of the crossover data, "Out Configuration" and "Stereo In-Link" must be set to off/off in the DCX2496 setup. If the setup is different from the default, x1Designer adjusts the setup accordingly. A message indicates this.

2.5 Module „Enclosure“



With the cabinet designer create a speaker box quickly and easily. All dimensions are taken from the database. The parts list output makes procurement a breeze once the design is complete.

2.5.1 Procedure

- Set dimensions of the housing
- Enter width, height, depth in cm. Click on the box - symbol
- Note: Can be changed later.
- Select housing material from the database
- Select the material under "Enclosure material" and press the "Set" button.
- Add the loudspeakers:
  - From the project: the list on the right shows all the speakers in the project. Select a speaker and click the "Chassis from project" button to place it
  - Directly from the database: Select a chassis in the speaker database. Then press the "+Chassis" button in the "Cabinet" module. The loudspeaker will be placed
  - Extras: Use the popup menu to place a bass reflex channel or a cabinet subdivision.

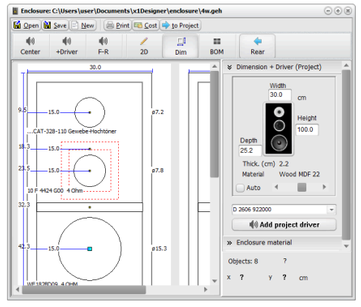
2.5.2 Icon „Module“

Button	Description
Open	Open enclosure
Save	Save enclosure
New	Clear enclosure
Print	Print enclosure
Cost	Calculate cost (without driver)
To Project	Hand over enclosure to project. Please save first the design as a file!

2.5.3 Icon „Drawing“

Button	Description
Center	Center all objects
+Driver	Place currently selected loudspeaker from the Chassis database
F-R	Place object on the front or back of the housing
2D	View with speakers and extras. View for placing the objects
Dim	View with all dimensions
BOM	Show parts list (without loudspeaker, only housing)
Rear	Show objects on the back or front side

View „Dim“



2.5.4 Enclosure size, Zoom, Project Chassis

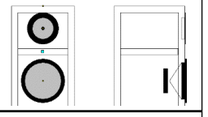
	Description
Width, Depth, Heigth	Input of the box dimensions in cm. The click on the box sets the dimensions
Auto	Automatic scaling of the view when enabled
Slider	Zoom slider. Active only when AUTO is not selected. Slider to the right enlarges the view
Chassis list	List with all chassis from the current project
Add project driver	Click places the current chassis selection in the enclosure

2.5.5 Enclosure manterial

	Description
List	List of all materials for housing construction from the article database
Set	Adopt selected material for the current housing
Thick	Material thickness in cm
Price	Price per square meter (sqm)

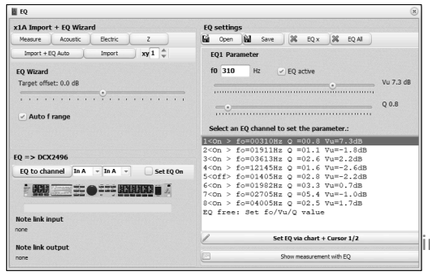
2.5.6 Popup-Menu

The popup menu is displayed when the mouse cursor is over an object (e.g. loudspeaker) in the front view (2D, left view) and the right mouse button is pressed:

Menu	Description
Center	Center all objects
Volume (change)	Adjust volume of box to default (no "volume limiter" present in inner case): - Choose which dimension may be changed: H=Height, W=Width or D=Depth. - Enter the net volume - The variable housing dimension will be adjusted to reach the target volume. Enclosure with volume delimiter: move the mouse a few pixels above or below the anchor point of the volume delimiter (divider board). Below the anchor point if you want to change the volume below. - The right mouse click opens the dialog and shows the current volume. - Confirm the dialog with "YES" to change it. - Enter the new volume - The volume limiter will be re-positioned to create the target volume 
Properties	Change dimensions, e.g. speaker diameter
Position x/y	Change the object position. Input distance "Left (x)" and "Top (y)" in cm
Delete	Delete object
Add „Cut out“	**Round:** Input diameter in cm **Squarer:** enter height & width in cm
Add „Driver“	**Tweeter Round:** Input diameter inside & outside as well as depth **Tweeter Square**: Input outer height and width, installation diameter round as well as depth **Driver round**: Input diameter inside & outside as well as depth of the speaker **Tweeter Square Square**: Like ribbon with rectangular installation opening
Add „Others“	**Volume limiter**: Inserting a "divider board" to divide the cabinet into 2 parts. **Mid-range sub enclosure:** Inserts a small rectangular enclosure, e.g. for a mid-range driver **Bass reflex port round:** Inserts a round opening for a bass reflex tube

e

2.6 Module „EQ“



Via the "EQ" module, you calculate an equalizer (EQ) setup with which you can linearize the acoustic frequency response of your box. The starting point is the measurement of the speaker cabinet with the Audio Analyzer x1Analyzer, which you import at the push of a button. Subsequently, the EQ setup can be determined in three ways:

- **Automatic**: With the "Import + EQ Wizard" stute.x1D calculates the configuration fully automatically. Manual adjustments are possible later
- **Semi-automatic analysis**: In the XY window, mark the frequency response range to be corrected with cursor 1 and 2 and let stute.x1D calculate the EQ. Repeat this for further ranges. Manual adjustments are possible
- **Manual**: Enter EQ parameters manually (gain, Q, f0).

For all three methods, the simulation shows the expected result of the acoustic frequency response. This saves time and measurements.

Note: The aim of EQ correction is to tune the frequency response as linear as possible.

2.6.1 EQ setup transfer to audio prozessor

Once the EQ setup is determined, it can be transferred to the DCX2496 audio processor for an acoustic pre-test of the crossover with a click. Alternatively, the EQ configuration can be manually transferred to another digital audio processor, e.g. mini DSP.

Procedure

- Import an acoustic measurement from the Audio Analyzer x1Analyzer.
- The wizard calculates the EQ configuration and shows the expected frequency response in the XY window
  - Channel 1 shows the result with the EQ correction
  - Channel 5 the imported frequency response
  - Channel 6 the default "target", a linear line through the measurement.
- Adjust the EQ configuration if necessary and run the simulation again to check until it fits
- Transfer the EQ configuration to the audio processor

2.6.2 Block „x1A Messung + EQ Wizard“

Button	**x1A Function**
Measure	Start measurement x1Analyzer. Measurement mode see below
Acoustic	Set measurement mode acoustic frequency response
Electric	Set measurement mode electric frequency response
Z	Set measurement mode Z

Function	Description
Import + EQ-Auto (Automatic)	Import a measurement from the XY window of the x1Analyzer. Select the channel number with the measurement via the selection "xy". After the import the EQ Wizard calculation starts. Afterwards the EQ configuration is shown as well as the frequency response simulation. Note: The EQ configuration can be adjusted manually afterwards.
Import (Semi-Automatic	Import a measurement from the XY window of the x1Analyzer. Select the channel number with the measurement via the "xy" selection. Set the EQ configuration manually: • - Option 1: Mark a range in the frequency response with the cursors. Then press the "Determine EQ from..." button. The correction via an EQ is calculated. Adjust the window if necessary • - Option 2: Enter fo, Vu and Q manually. Check the result with the simulation. Press the "Determine EQ from..." button.
XY	Channel number for importing the measurement. The number refers to the xy channel of the x1Analyzer program.

Button	Description
Auto f range	**Selected:** The program determines the frequency range for EQ calculation by the wizard. **Not selected:** Manual input of the start/stop frequency for the wizard. Use the "fstart" and "fstop" fields.
fstart	"Auto f range" is deactivated! Enter the start frequency in Hz for the EQ Wizard. Between "fstart" and "fstop" the EQ Wizard tries to correct the deviations with EQ settings.
fstop	"Auto f range „ is deactivated! Entering the stop frequency in Hz for the EQ Wizard
Target Offset	The aim of EQ correction is to bring the frequency response close to the straight "target" line. Adjustment of the offset value for the y-axis to the target frequency response in ±0.1dB steps.

2.6.3 EQ settings

2.6.3.1 Basics

Button	Description
Open	Open EQ setup
Save	Save EQ setup
X EQ	Clear the selected EQx (select a EQ with the mouse = row blue if selected)
X EQ All	Clear all EQ

2.6.3.2 EQ Parameter

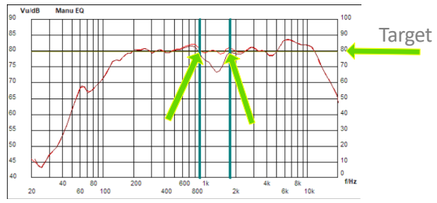
Element	Description
EQ active	Set selected EQ channel x (1..9) on or off
f0	Center frequency of the EQ filter in Hz, range 20Hz to 20kHz
Vu (slider)	Gain/attenuation of the EQ filter in ±0.1dB steps
Q (slider)	Gain/attenuation of the EQ filter in ±0.1dB steps
Set EQ via chart..	Determine the EQ settings for frequency response correction of the area between cursor 1 and 2 from the XY window
Show measurement with EQ	Display frequency response simulation

2.6.3.3 Automatic EQ calculation

- - Open the optional Audio Analyzer x1Analyzer program.
  - Load an acoustic measurement.
  - Ex.: The measurement is displayed in channel 1 of the xy window.
- Open the x1Designer program
  - Select the "EQ" module
  - Set the selection "XY" to 1 (channel 1 from x1Analyzer)
  - Press the "Import+ EQ-Auto" button
  - The EQ configuration as well as the XY screen with the simulation result is displayed
  - If necessary, modify the EQ parameters manually

2.6.3.4 Semi-automatic EQ calculation

- Import a measurement from x1Analyzer
- Open the x1Designer program
  - Select an EQ number (1..9) from the list with the mouse
  - Fade in the XY screen channel 6 "target" (horizontal line)
    - In the example below approx. at 79dB
  - Mark the area to be corrected with the cursor 1 and 2 in the XY window
  - Good positions for cursor 1 and 2 are the intersections between curve 5 "x1A Import" and 6 "Target"
  - Press the button "Determine EQ from the ..."
  - The EQ is calculated. The result is made visible in the simulation
  -



2.6.3.5 Improve results (Automatic & Semi-Automatic)

Sometimes you get better EQ results if you change the level of the target frequency response (Target) a little bit via the offset, channel 6 in the XY diagram. Important are the intersection points with the "import of the measurement" in channel 5. The better the area to be corrected is marked by the intersection points, the better are the results of the EQ calculation.

2.6.3.6 Set EQ setup manually

- Open the optional Audio Analyzer x1Analyzer program.
  - Load an acoustic measurement, e.g. in channel 1.
- Open the x1Designer program
  - Select the "EQ" module
  - Set the "XY" selection to "1".
  - Press the "Import" button
  - The XY screen shows the imported measurement
  - Select an EQ line/number and set the EQ values manually
  - Press the "Show result with EQ" button (simulation result).
- Repeat the step for further frequency ranges

2.6.4 Transfer EQ to DCX2496

	Description
EQ to channel	Transfer of the EQ configuration to the DCX2496. The target channel is done via the selection boxes (see below)
1. list “In A…”	Sets the DCX2496 destination channel for EQ configuration: Sum, In A,B,C or Out 1,2,3,4,5,6. Default: "In A". Note: With the destination "Input" (e.g. In A) the EQ configuration affects all assigned outputs in the DCX2496 setup, e.g. mid-woofer, mid-range and tweeter.
2. list “In A”	Second target channel, description as before. Target channel also contains "Off" for 2nd channel inactive
Set EQ on	**Selected:** Turn on DCX2496 EQ at next click on "EQ to channel". **Not selected:** Switch off DCX2496 EQ at next click on "EQ to channel

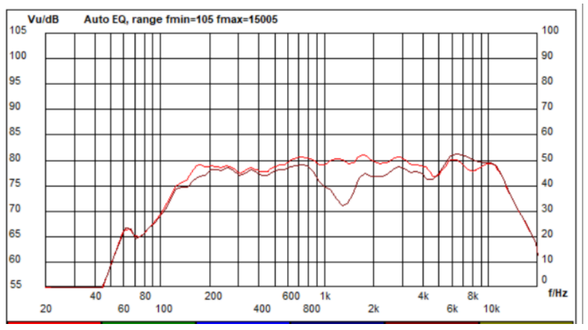
2.6.5 Supported EQ parameter

- Max. 9 EQ
- For each EQ:
  - EQ center frequency from 20Hz to 20kHz, 1Hz step size.
  - EQ gain ±15dB, 0.1dB step size
  - EQ Q factor 0.1 to 10, 0.1 step size
  - EQ on/off

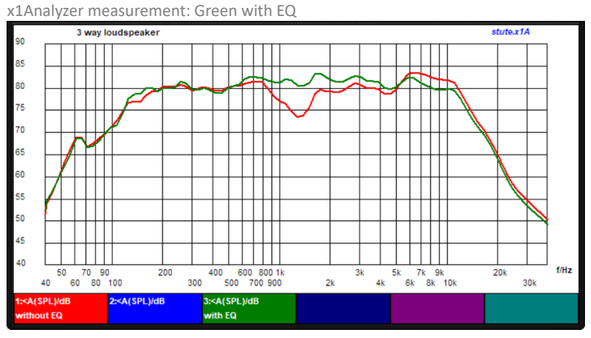
Note for transfer to the DCX2496: The DCX2496 does not support Hertz exact frequency input (e.g. 1001Hz, 1002 Hz...) or Q input in 0.1 steps (2.1/2.2/2.3 ...) over the whole Q range. The values from the EQ setup are adjusted in the DCX2496 to the supported values and may differ a little from the shown EQ setup.

2.6.6 Test: EQ simulation + Comparative measurement

x1Designer Simulation: Green with EQ, red without EQ (measurement from x1Analyzer)

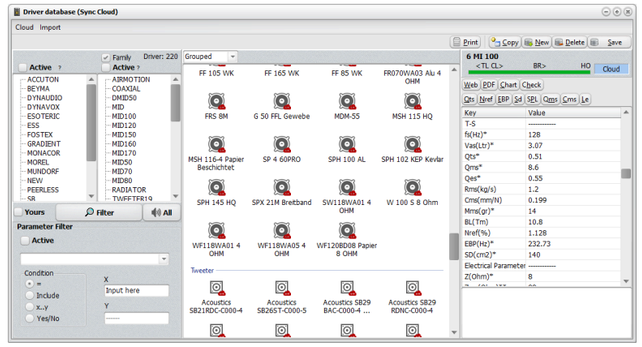


x1Analyzer measurement: Green with EQ



2.7 Module „Driver-Database“

The module contains the powerful local loudspeaker database, where a lot of data is stored for each loudspeaker (T-S parameters, manufacturer, type, dimensions, price, link to web...). Multiple filter functions help to find the right chassis and you can add new speakers simply by entering the parameters or importing them.



2.7.1 Cloud-Service

The free cloud service allows you to use and edit your chassis from the local database in a team on different PCs. Your chassis entries are private and are not shared with all x1Designer users, because the data sets are marked with a unique UserID.

To access your chassis from another PC, your UserID must be stored in the setup of the second PC. You can find your UserID in the header of the "Home" module or in the setup. There you can also switch the service off or on.

2.7.1.1 Cloud Master Chassis

Chassis pre-installed in the Cloud by Stute Engineering can be obtained via the Cloud Service that is switched on (see Setup). These speakers are marked with a red cloud in the listing (see picture below) and cannot be edited / deleted.

If you want to use the speaker customized, create a copy via the "Copy" button. Via the filter "Your" all Cloud Master chassis are hidden.

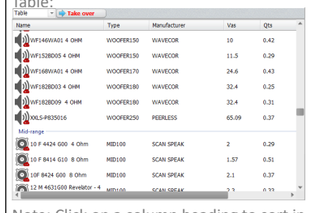
2.7.2 Menu header

	Description
Cloud	Synchronize chassis database with the cloud. Note: Synchronization is done automatically at program start and end if enabled in setup
Import	
Driver	Stute Engineering format (*.spk)
SpeakerSIM	SpeakerSIM format (loudspeakerdatabase.com)
WinISD	WinISD format (loudspeakerdatabase.com)
Get T-S Data (x1A)	Import T-S parameter from Audio Analyzer x1Analyzer
Database x1D <2.5	Import database stute.x1D Designer version less 2.5. Attention: Deletes all personal entries in the database. Note: Press the "Cloud" button to reload the Cloud Master Chassis after the import.

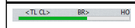
2.7.3 Buttons

	Description
Print	Print driver details
Copy	Create a copy of the selected driver. Tip: Create a editable copy of a Cloud Master Chassis
New	Create a new empty driver . Important: Save after data input
Delete	Clear driver. Note: Not possible for cloud master driver
Save	Save driver. Note: Not possible for cloud master driver

2.7.4 Change driver list

	Description
Grouped...	Modify view: Grouped: Grouped according driver type  List:  Table:  Note: Click on a column heading to sort in ascending order
=> Take over	 Transfer selected loudspeaker to the requesting module. Note: Displayed only under if the transfer to other module was requested.

2.7.5 Chassis parameter

	Description
	Enclosure recommendation for the chassis shown : <TL: Transmission Line, green bar to the left of TL. CL>: Closed, green bar right from CL and up to BR BR>:Bass reflex, green bar on the right from BR to HO HO: Horn
	Cloud Master Chassis, see corresponding chapter
Web	Display web page saved to the speaker in the browser
PDF	View PDF file saved to speaker (PDF Reader required)
Chart	Display measurement saved to loudspeaker (name measurement program in setup)
Check	Checking the chassis parameters for validity
Taste	**Calculation of missed parameter**
Qts	Calculate Qts
Nref	Calculate Nref
EBP	Calculate EBP
Sd	 Calculation Sd (effective membrane area). Important: For calculation, enter diaphragm diameter in cm WITHOUT bead. Do not enter the diameter of the driver or the frame! Note: The area is not flat and therefore turns out slightly larger.
SPL	Calculate sound pressure level
Qms	Calculate Mechanical Q factor
Cms	Calculate Mechanical suspension
Le	Calculate Voice coil inductance

2.7.6 Driver specifications

	Description
Type	Select or enter the speaker type from the selection. Scroll the list with the cursor keys. The following types are allowed in combination with the diameter, e.g. Tweeter25 (tweeter 25mm) : - "Tweeter" tweeter, e.g. "Tweeter28" for a dome tweeter 28mm - "DMID" (Dome Midrange) = dome midrange driver, e.g. "DMID50" for a 50mm dome midrange driver - MID" (Midrange driver)= midrange driver, e.g. "MID130" for a 130mm cone midrange driver - Woofer" = bass speaker, e.g. "Woofer300" for a 300mm bass speaker - "Radiator" = passive cone - "Airmotion": Heil Airmotion Transformer - "Other" Other types not covered by the above terms.
Name	**Unique loudspeaker designation. Identical designation of a loudspeaker is not possible!**
Manufacturer	Manufacturer name
Price	Price of the speaker. Used for cost calculation
Art. Nr	Item number of the supplier or manufacturer
Web	Link to the manufacturer's product page or store. Display via the "Web" button
PDF	Link to driver PDF file. Display via „PDF“ key
Measurement	Link to measurement file. Display via the "Chart" button
SPL	Sound pressure level in dB
T-S	Thiele Small Parameter (see below)
Electr. Parameter	Electrical parameter (see below)
Voice coil	Drive details (see below)
Dim	Dimensions according to the selected shape
Shape	Select shape from the selection: Round: Outside "Round" and installation opening "Round". Rectangle: Outside "Rectangular" and installation opening "Round Rectangle-Rectangle: Outside "Rectangular" and installation opening "Rectangular
Comments	At the bottom of the list you can enter a short description

2.7.6.1 Thiele-Small Parameter

	Description
fs	Resonant frequency free air
Qms	Mechanical Q factor
Qes	Electrical Q factor
Qts	Q factor total
Vas	Equivalent volume in liters
Nref	Reference efficiency
EBP	Energy Bandwidth Product ((1/Qes)•fs)
Sd	Effective membrane area in cm2
BL	Driver force factor
Cms	Mechanical suspension
Mms	Moving mass
Rms	Mechanical resistor
SPL	Sound pressure level 2.83V@1m

Tip Wiki T-S parameter

2.7.6.2 Electrical parameter

	Description
Z	Impedance Nominal
Zres	Impedance at the outdoor resonant frequency
Re	Voice coil DC resistor
Le	Voice coil inductance
MaxPower	Maximum power / Max. power handling
RMS	RMS power handling

,

2.7.6.3 Voice coil

	Description
Height of gap	Air gap height
Xlin	Maximum linear displacement ± mm
Xmax	Maximum displacement ± mm

2.7.7 Filter

On the left side you will find numerous filters for targeted search. Select a filter function and press the "Filter" button. The list in the middle shows the matching chassis. Press the "All" button to end filtering and return to the overall.

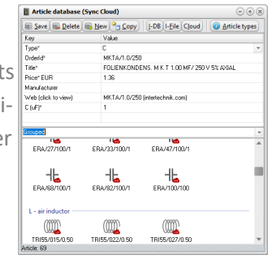
2.7.7.1 Express filter

	Description
Manufacturer	Select a manufacturer. Set a check mark at "Active" and press the "Filter" button
Type	Select the driver type, like "Woofer300" (Bass 30cm) or "Tweeter25" (Tweeter 25mm). Set a check mark at "Active" and press the "Filter" button. Family" option is set: Size is not considered, e.g. for "Woofer300" all "Woofer" are shown, regardless of size.
Yours	Hide all Cloud Master chassis (explanation in the manual). Only chassis that you can edit are displayed

2.7.7.2 Parameter Filter

	Description
Active	Filter active
Selection	Select a parameter after which to filter
Condition	Select a condition: = : Result corresponds exactly to the search criterion. Include : result contains the search criterion, e.g. all chassis containing "DX" in the name, like “driver G200 DX4” x..y : range, like "Vas" from 20..50 Yes/No : currently without application Enter the search criterion in the textbox(es)

2.8 Module “Article-Database”



Using the free cloud service, you can use and edit your articles from the local database in a team on different PCs. Your article entries are private and will not be shared with all x1Designer users, as the records are marked with a unique UserID.

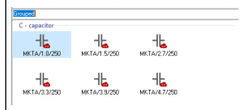
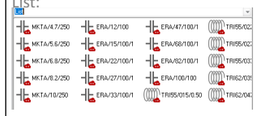
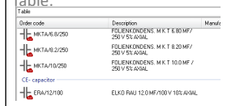
For more details, see the “Driver database “chapter.

2.8.1 Cloud-Service / Master article

2.8.2 Buttons

Button	Description
Copy	Create a copy of the selected article Tip: Cloud Master article customized for further use
New	Create a new "empty" article in the database. Important: Must be completed with "Save" after entering the data.
Delete	Delete article. Note: Not possible for Cloud Master items
Save	Save article. Note: Not possible for Cloud Master items
I-DB	Import database stute.x1D Designer Version less 2.5. Attention: Deletes all personal entries in the database. Note: Press the "Cloud" button to reload the Cloud Master Chassis after the import.
I-File	Import from CSV file , file extension "*.art", separator ";". The file can contain several items. Syntax: Line 1 fix => „x1D;type;orderid;note;price;vendor;web;v_main;v_option“ Line 2… => as described in line 1 Type: „R“=Resistor => main_v = Resistor in Ohm „C“=Capacitor => main_v = Capacity in µF „CE“=Elko => main_v = Capacity in µF „L“=air inductance => main_v = Inductance in mH, v_option = DC resistor in Ohm „LK“= Inductance with core => main_v = Inductance in mH, v_option = DC resistor in Ohm „W“= Enclosure material => Thickness in cm Sample: *L;TRI55/015/0.50;TRITEC COIL 0.15 MH 7 X 0.50 MM ;19,9;;https://www.intertechnik.com/shop/inductors/tritec-hexagonal-awg10-15/ite-tri55015050,583193,en,80,1157765;0,15;0,12;*
Cloud	Synchronisation of the local database with the cloud
Article types	Display explanation of article types, such as "R" or "LK”

2.8.3 Darstellung Artikel Liste ändern

	Description
Grouped…	Type of article list view: Grouped: Grouped via article type  List:  Table:  Click on a column heading to sort in ascending order

2.8.4 Details to article

Data	Description
OrderId	Unique name of the item. It is not possible to name an article identically!
Type	Article type (see chapter „Button I-File“)
Title	Description
C µF..	Inputs to the selected material: Type R: Resistance in Ohm Type L, LK: Inductance in mH and DC resistance (wire) in Ohm Type C, CE: Value in µF
Manufacturer	Name Manufacturer or Dealer
Price	Price. Currency see setup
Web	Internet link to the material on the manufacturer's or dealer's website (online store). Press the "Web" button to display the page in your default web browser.

3 Setup

3.1 Path

Define here the default storage locations for the file types listed below. The "..." button opens the dialog for selecting the storage locations.

Important: The default "Project directory" from the "Project" module has priority over all directories listed here!

Path	Description
Audio crossover	Location crossover files
PDF	Location PDF files named in the chassis database.
Enclosure	Location enclosure files
Project	Location project files

3.2 Measuring Software

The module "Project can save a measurement file to the project, e.g. the frequency response measurement of the whole box. For viewing the path to your measuring program is needed, e.g. Audio Analyzer stute.x1Analyzer. For the display to work smoothly, your measuring program must support the opening of a file by the following call:

Syntax: “Program”+ “space”+ “Measuring file ”

Beispiel: c:\program\MyAudioprogram.exe c:\data\MyBoxMeasurement.data

Use the "..." button to select the measurement file.

3.3 Database

Use the "..." button to select the database file.

File	Description
Component	Article database
Driver	Driver database

3.4 X-Over REALizer

	Description
Threshold L-LK	Limit value for automatic exchange of inductance: change between air core coil - coil with core (type L<->LK), if the function "REALizer" is executed in the crossover module.
Threshold C-CE	Limit value for automatic change of capacitance: change between capacitor - electrolytic capacitor (type C<->CE) when the function "REALizer" is executed in the crossover module.

3.5 Currency

Input of the currency. A conversion does not take place.

3.6 Cloud Service

Note: The cloud service is free of charge.

The selection box switches the synchronization of the local chassis and article database as well as the project files incl. cabinet & crossover with the cloud on or off. The synchronization is done at program start and end. Alternatively, it can be triggered manually. Via the cloud, your inputs / designs (files) can be shared and edited with other PCs. This is helpful for working on your second PC or in a team.

By marking the data with your UserID, the data is protected and only visible to the circle who know the UserID.

3.7 UserID

The ID is PC dependent. To access your data via cloud service on other PCs, enter your UserID from PC A on PC B (PC B sees data from PC A) and vice versa. The same applies to working in a team.

3.7.1 Own UserID

The first entry is your personal UserID and cannot be changed. Your own UserID is also displayed in the header of the "HOME" module.

3.7.2 Add a UserID

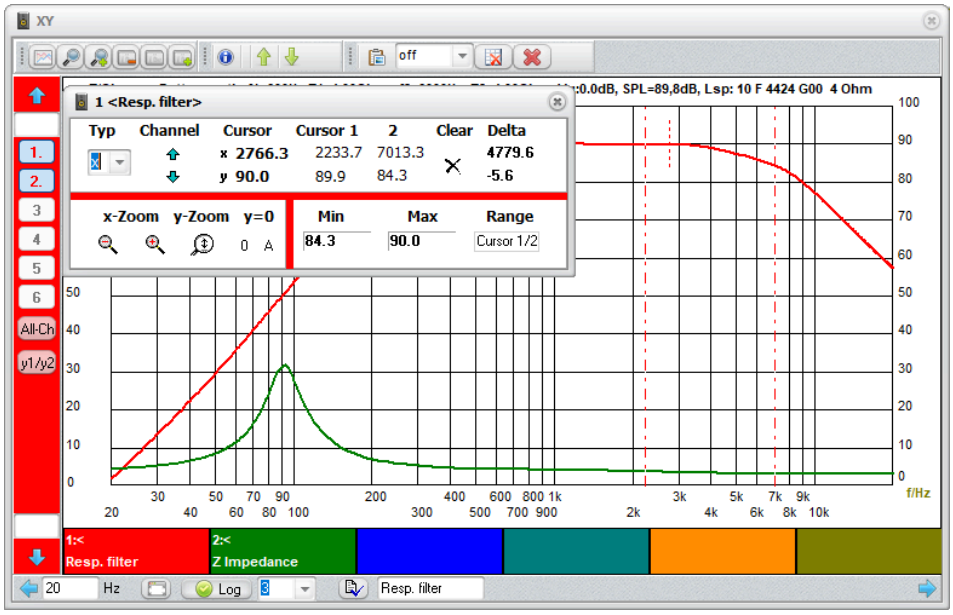
Add more ID's to the list by pressing the "+ Add UserID" button. Max 9 can be added. Delete an ID by selecting it in the list and deleting the text with the "Del" key of the PC keyboard.

4 System requirements

- MS-Windows 10 or 11 (32 or 64 bit)
- Internet connection
- Screen min. 1280 x 1024 pixel

Try x1Designer. Download the free demo version from the web.

http://stute-engineering.de
Subject to change without notice



Appendix
XY screen

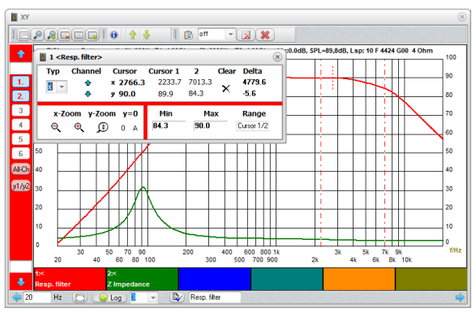
STUTE Engineering

A XY screen

Note: The XY window is used in various software products from Stute Engineering. The diagrams or functions shown here may therefore differ.

Features:

- Parallel display of up to 6 measurements
- 2 y-axes
- x-axis linear or logarithmic
- Extensive cursor functions
- Mathematics
- Zoom and smooth the measurement curve
- Copy & Paste of the measurement curve
- Notes for measurement 1 to 6 as well as for the total measurement
- Copy measurement graph to clipboard
- Show/hide individual measurements
- Freely scalable window



A.1 Basic function

A.1.1 Identify active channel

You identify the selected channel by the background color of the channel menu on the left. The color corresponds to the channel color 1..6 from the footer of the XY window. Red means that channel 1 is selected.

A.1.2 Select active channel

Note: Many operations refer to the selected channel (active channel), such as moving curves or zooming.

- Move the mouse cursor to the corresponding channel key 1..6
- Press the right mouse button over the channel key, e.g. 1.
  - The background color changes to the channel color, in the example to red.
  - The channel is now selected (active)

A.1.3 Show/hide single channel

- Move the mouse cursor to the corresponding channel key, e.g. 1
- Click on the button to hide the channel
- Click again to show the channel again

A.1.4 Show active channel only vs. all channels

Press the "All-Ch" key once: Show active channel only. Press the "All-Ch" key again to show all channels.

A.1.5 Indicate channel with data

A channel number with a dot after the channel number indicates that the channel contains measurement data. Without a dot, there is NO measurement data.

A.1.6 Input notes

A.1.6.1 Each channel

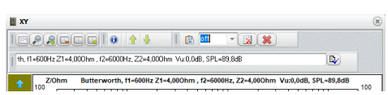
Input short note:

- Option 1 Footer:  : Enter the text related to the active channel in the text field and press the button
- Option 2 via „Tools“: Select the key from the XY icon bar. Select the "Texts" tab. Enter the text here for each channel

The text is displayed here 

A.1.6.2 Measurement

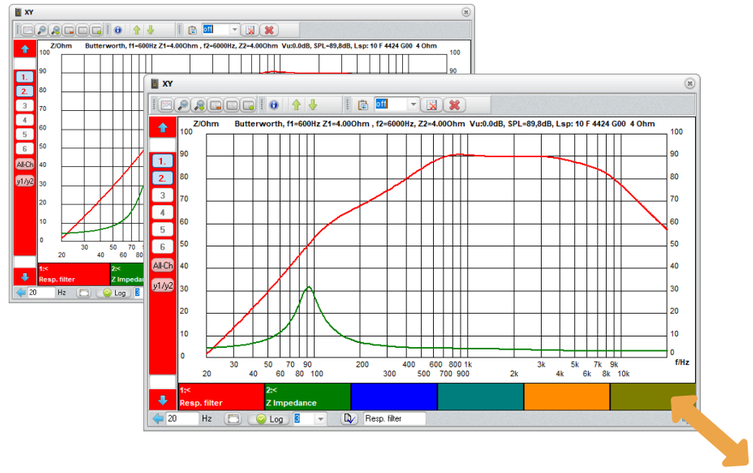
Press the button : Input the measurement headline



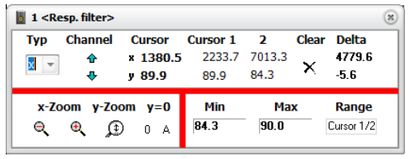
A.1.7 Re-size XY screen

The window width and height can be adjusted to your needs.

- Place the cursor on the border area of the window
- The cursor character changes
- Hold the left mouse button and drag the window to the desired size



A.1.8 Cursor-screen



A.1.8.1 View data to cursor position

- Move the mouse cursor to the measurement diagram
- Press the left mouse button
- The window Measurement data cursor appears
- Move the mouse cursor to the position of the diagram you want to read out
- Below "Cursor" the measured values to the cursor position are shown

A.1.8.2 View delta between Cursor 1 & 2

The difference display is helpful when analyzing the measurement data. This can be used, for example, to check the slope (dB/octave) of a crossover.

- Move the cursor to the measurement diagram
- Activate the cursor view, left mouse button
- Position the cursor on the first frequency (position 1) and press the left mouse button again, e.g. at 1kHz
- Position the cursor on the second frequency (position 2) and press the left mouse button again, e.g. at 2kHz
- The difference between cursor 1 and 2 to the x- and y-axis is displayed at "Delta":
    - Delta x = f2 – f1, Delta y= y2-y1

A.2 Main functions

A.2.1 Header

A 1 2 3 4 5 6 7 8 9 10 11 12 13

A#	Description
1	Display "Tools" window: Mathematical function and text input for measurement
2	Display measurement curve completely
3	"Zoom In" to the area from cursor position 1 and 2
4	Cut the trace of the selected XY channel
5	Copy trace of the selected XY channel
6	Insert trace into the selected XY channel

A#	Description
7	Text input for measurement. Display in the header xy diagram
8	Shift active channel's trace downwards (change measured values)
9	Shift active channel's trace upwards (change measured values)
10	Copy measurement diagram to clipboard
11	Smooth active trace
12	Delete all measurements in the xy view
13	Delete active channel

A.2.2 Menu y-axis

	Description
	Increase scaling y maximum
	Enter the value for y Maximum. **End the input with the "Tab" key on the PC keyboard.**
	Measuring channel 1..6: • Press key: Show/hide measuring channel • Right mouse button: Select channel as active. The background color of the menu shows the color of the selected channel (in the example red = 1).
	Toggle: Display all channels or only the active one
	Assign measurement data of the active channel to the y axis 1 (left) or right (2). Tip: The character "<" or ">" in the color field for each channel shows the assignment to the y axis. "<" left y-axis, ">" right y-axis
	Enter the value for y Minimum. **End the input with the "Tab" key on the PC keyboard.**
	Decrease scaling y minimum

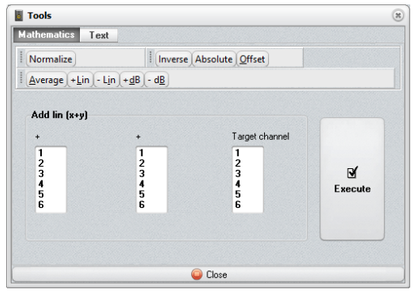
A.2.3 Menu x-axis

A1 2 3 4 5 6 7 8 9

A#	Description
1	Decrease scaling x minimum
2	Enter the value for x Minimum. End the input with the "Tab" key on the PC keyboard.
3	x Set axis to default (3 decades, log, start 20Hz)
4	Display x axis linear or log.
5	Number of decades (log only)
6	Confirm text input, see #7
7	Text input to active channel
8	Only visible with x-axis “lin”: Enter the value for x Maximum. End the input with the "Tab" key on the PC keyboard.
9	Increase scaling x maximum

A.2.4 Tools

A.2.4.1 Tab „Mathematics“



-Lin	Difference of two measurement curves. The result is displayed in the target channel: + : Select the channel number from which something is to be subtracted. - : Select the channel number to be subtracted from the "+ channel". Target channel: The result is displayed in the selected channel
-dB	Difference of two measurement curves with a dB scaling on the y-axis. The result is written to the target channel (target): Target(dB) = 20* log(10^(+channel#(dB)/20) - 10^(-channel#(dB)/20)) + : Select the channel number from which something is to be subtracted. - : Select the channel number to be subtracted from the "+ channel". Target channel: The result is displayed in the selected channel
+Lin	Addition of two measurement curves. Function similar to "Sub lin
+dB	Addition of two measurement curves. Function similar to "Sub dB
Average	Averaging of individual measurement channels: Source: Select measurement channels (e.g. 1,2 and 4). Target channel: Show result in selected channel (e.g. "5" for channel 5).

Merge (not available in x1Designer) Example: Subwoofer measurement in channel 1, front speakers in channel 2, transfer point of the measurement curves from the subwoofer to the front speakers is at 200Hz Target/TT = 1 source = 2 f=200 The result is displayed in channel 1	Assemble measurement diagram from 2 single measurements to one frequency. Target/TT : Number of the target channel with the already available measurement data to the subwoofer. Source : Number of the channel with the measurement data to the front loudspeaker f : Crossover frequency in Hz. Below f, the measurement data from the "Target/TT" channel is used and above from the "Source" channel. The result shows the channel number "Destination/TT".
Normalize Example: Level of channel 1 +3dB above that of channel 3. Level of channel 2 -5dB below channel 3. It is difficult to compare the measurements Solution: Adjust the level of the measurement curves. Calculate offset to frequency of 1kHz for all curves individually and move the measurement curves accordingly Input => channels = 1,2, reference = "3", "Applies to" = "1000".	Shift different traces to the level of the reference channel (normalize traces). The level is determined to the frequency f of the reference channel: Channel : Selection of channel numbers, e.g. channel 1 and 2. Reference channel : Number of the reference channel For value x: Frequency input (reference point for all traces)

All channels (only Absolute and Offset)	Active: The functions shown below affect ALL measuring channels. De-active: Only the SELECTED channel is changed
Offset	Shift measurement curve by the offset value Note: Channel input is not required if "all channels" is selected
Absolute Sample: Measured value from channel 1 at 1kHz 60dB. The new value (set point) should be 90dB Input: channel =“1”, “for value x” = “1000” and “set point” = 90	Shifting the measurement to a target point. The target point is given by a frequency and the set point to the frequency. Channel: Channel number For value x: Frequency to the preset value "set point". Set point : Set point/level to frequency "by x". Note: Channel input is not necessary if "all channels" is selected.
Inverse	Invert the measured values

A.2.4.2 Tab „Text”

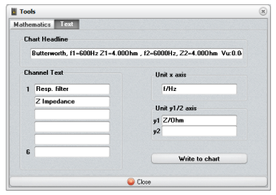
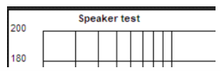
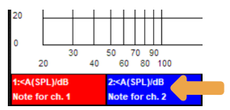


Chart headline	Headline for measurement 
Channel text	Short note to each channel 
Unit x axis	Unit x axis
Unit y1 y2 axis	Unit y1 y2 axis
Write to chart	Write headline, unit, short note to chart

A.3 Cursor screen

With the cursor view you can easily read and analyze the curves, such as the attenuation of a crossover (dB/ octave). Vertical (x) and horizontal cursors (y) are available. To display the measurement data, a cursor in the form of a semicolon line is displayed and another window, which shows data on the cursors (cursor current pos., cursor 1 & 2).

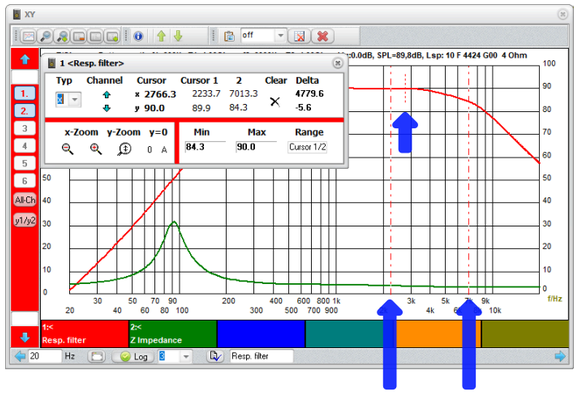
A.3.1 Enable the cursor screen

You activate the cursor view with a mouse click (left button) in XY window. Another left mouse click sets the cursor position 1, e.g. to a certain frequency, like 100Hz. To set position 2 move the cursor to the corresponding position and press the left mouse button again, e.g. to the position 200Hz. The cursor position 2 is set, also a green line. The "Cursor View" window now shows the x/y values to position 1 and 2 as well as the difference.

Another mouse click at another position deletes cursor 2 and sets cursor 1 again. You delete the cursor by closing the cursor view.

Note: You switch between horizontal and vertical cursor via the "Type" selection.

Values to cursor position

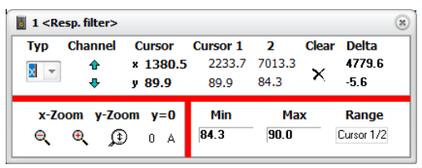


Cursor

A.3.2 Details

A#	Description
Note	- The background color corresponds to the color of the selected channel, e.g. RED = channel 1 - The active channel (text in the frame) can also be changed here via the Channel Up/Down keys (see #2)
1	"x/y": switch between horizontal and vertical cursor
2	Channel Channel: Change channel (1..6) from which the measured values are read out
3	“Cursor”: Zeigt x & y Messwerte zur Cursorposition des gewählten Kanals (siehe #1)
4	"Cursor": Shows x & y measurement values to the cursor position of the selected channel (see #1)
5	"Cursor 2 ": Shows x & y measurement values to cursor position 2 of the selected channel
6	"Clear": "x" key clears cursor 1 & 2
7	"Delta" : Shows x and y difference to cursor position 1&2 (x Pos. 2 – x Pos. 1 und y Pos 2 – y Pos 1)

A 1 2 3 4 5 6 7



B 1 2 3 4 5

B#	Description
1	"Zoom In" to the area from cursor position 1 and 2. Via function B#2 back to the display of the entire trace (reset x-axis).
2	Show the complete measurement (reset the x-axis according to the measurement data of the active channel)
3	Fit the y-axis to the measured values to the selected measuring channel
4	0: Shift the measurement curve so that the measurement diagram of active channel at cursor position 1 receives the value "0". A: Like "0", but all measurement curves are shifted
5	**Text "Cursor 1/2": (Cursor ½ set)** Shows "yMin" and "yMax" value between the cursor positions 1 and 2 (active channel). **Text "All": (Cursor ½ not set).** Shows "yMin" and "yMax" value to the whole measuring range (active channel)