OWNER'S MANUAL

LAP-2.V3

ANALOG PREAMPLIFIER

FUNK TONSTUDIOTECHNIK

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IMPORTANT SAFETY PRECAUTIONS

The following applies to all versions of LAP-2.V3

Always follow the basic precautions listed below to avoid the possibility of serious injury or even death from electrical shock, short-circuiting, damages, fire or other hazards. These precautions include, but are not limited to, the following:

CAUTION! :

Only use the voltage specified as correct for the device. The required voltage is printed on the bottom plate of the device. Standard is 230 Volt/50..60 Hz! 115 Volt/60 Hz optional

To prevent fire and/or electric shock, the device can not be exposed to rain or moisture!

If the power cord or plug becomes frayed or damaged, or if there is a sudden loss of sound during use of the device, or if any unusual smells or smoke should appear to be caused by it, immediately turn off the power switch, disconnect the electric plug from the outlet, and have the device inspected by qualified Funk Tonstudiotechnik service personnel.

If this device should be dropped or damaged, immediately turn off the power switch, disconnect the electric plug from the outlet, and have the device inspected by qualified Funk Tonstudiotechnik service personnel.

Do not attempt to disassemble the internal parts or modify them in any way. If it should appear to be malfunctioning, discontinue use immediately and have it inspected by qualified Funk Tonstudiotechnik service personnel.

CAUTIONS ON INSTALLATION :

Do not install in the following types of places. Doing so could degrade the sound quality and/or cause malfunctions.

Places with significant vibrations or that are otherwise unstable
Near windows or other places exposed to direct sunlight
near heaters or other extremely hot places
extremely cold places
places with bad ventilation or high humidity
very dusty locations

BEWARE OF CONDENSATION :

In case of moving the device from a cold to a warm place, or used after a sudden temperature change, a vapor in the air could condense on the internal parts making correct operation impossible. To prevent this, or if this occurs let the unit sit for at least 1 hour at the new room temperature before using.

CLEANING :

To clean the unit, wipe gently with a soft cloth. This particularly applies to the version with gold or chrome plated front. Do not use any benzene, paint thinner, ethyl alcohol or other chemical agents to clean the unit as they could damage the metal surface, or plastic control knobs of the unit.

WARRANTY :

Warranty for parts and labour is granted for period of 3 years. Defects associated with the production or material defect, will be removed free of charge during this period. The warranty is void after unauthorized opening and/or interfering with the device by third parties!

LAP-2.V3 ANALOG STEREO PREAMPLIFIER / SIGNAL SPLITTER

1.0 APPLICATION :

LAP-2.V3 is ultra-linear preamplifier for both professional recording studios, High-End audio users and enthusiasts, who praise neutrality and transparency of sound. It was designed in order to choose which signal should be monitored as well as copying audio material from one stereo source to another without any loss of quality. Various devices can be connected using the LAP-2.V3 preamps, like Phono preamp, CD, CD-R, MiniDisc, DAT, iPod, sound card or DAB.

The LAP-2.V3 preamplifier was designed with use of our professional reference monitoring system for mastering labs and it creates wholly new quality standards in its class. Besides absolutely superior sound characteristics the LAP-2.V3 features very ergonomic and user friendly design. For example, signal levels can be separately adjusted for each stereo input. Also, each input can be connected to each output.

The device provides reference quality of sound with exceptional, flat response characteristics within extremely wide frequency spectrum and range of dynamics that is second to none. The level of non-linear distortion is so low, that it can not be measured using conventional measuring devices, because quality of the LAP-2.V3 surpasses the quality of most audio measuring devices.

LAP-2.V3 offers following functions:

1. ECORDING - signal routing between up to six analog sound sources
2. MONITORING - signal routing between up to six analog sound sources
3. 2 parallel monitor out for additional sub woofer
4. Signal splitting from 1 in to 4 outs for RECORD path
5. Level adjustment/matching for various devices
6. Change of impedance from hi input to low Ohm out
7. High quality headphones out
8. Separate mute switch for monitor and record outs
9. „Power-Down"- mute relay on monitor out
10. Input configuration is memorized after switching off or sudden power-down

The **LAP-2.V3** is equipped with 6 pairs connecting ports for asymmetric stereo sound sources (cinch /RCA). One of 6 signal sources can be select for recording independent from choice for monitor input (Record-Router). This stereo signal is fed simultaneously to 4 pairs of Cinch output connectors.

The audio matrix operates in contact-less mode. A high level of stability and distortion-free operation is achieved by this. The device can match levels between inputs and various „hot" devices' outputs, so rapid changes in levels during source switching are avoided.

LAP-2.V3 can work with active speakers as independent pre-amplifier or with a power amp (LAP-2.V3a version), or as expansion/upgrade of integrated stereo amp (LAP-2.V3b).

Hi quality, short circuit resistant headphone amplifier is easily accessible on the front panel.

Power supply of the unit is exceptionally carefully designed and built, which ensures superior technical parameters and stable behaviour of the device.

2.0 SWITCHING CIRCUIT :

Analog signal input switching of LAP-2.V3 is controlled digitally and works in full contact-less mode. A very high level of precision and fault-free operation has been achieved that way. Typical differences of level between left and right channels in the whole signal path of LAP-2.V3 are less then 0,01 dB in full clockwise, maximum position of level knob.

Thanks to step operation of the volume precise level recalling is obtained.

Dynamic range of 135 dB, marvellous frequency (below 0,5 Hz to over 1 MHz) and phase response as well as extremely low non-linear distortion with typical value of < 0,0001% THD (< -120 dB) in important middle frequency range. This allows for neutral and totally objective evaluation of a chosen sound source.

All analogical input signals are fed to active matrix by low noise input buffer stages. Thanks to that very high impedance inputs are supported and we obtain very low impedance, nearly 0 ohm, for the electronic matrix. Flimsy signals with relative high output impedance are passed without any distortion or lowering the level. Practically the signal source which is connected to the LAP-2.V3 sees no electrical load. The improvement is 20…100 times fewer load than in normal audio design input stages.

Buffering amplifiers before the active matrix ensure independent from impedance of chosen signal source values of crosstalk between neighbouring channels (this applies particularly to high frequencies). Such design gives high input channel separation values of typically 115 dB at 1 kHz. Small level drops caused by splitting signal (one signal split to monitor and record paths at the same time), typical for passive matrix, has been eliminated thanks to active switching method used in the LAP-2.V3. Inputs that are not selected are not disabled by short circuit, as it is seen sometimes in other devices.

Another advantage of this input buffering technology is non-significant drop of the signal at all work ranges and high input impedance of 2 Mega ohm range. Weakening of low frequency signals and danger of phase shift caused by often used output capacitors are completely eliminated thanks to hi impedance input stages of the LAP-2.V3.

Signal irregularities and/or distortion caused by transient resistances in wiring and connecting ports has been eliminated to ten times lower level then typical input circuits.

Normally switching of the electronic matrix in the LAP-2.V3 is not audible. In German Broadcast stations they have the following assumption to say the switching noise is negligible:
”the switching noise must be – 60 dB qp weighted down from the normal audio level”. If you provide 2 Inputs with the same signal with same level and switch between these inputs, you will likewise not hear any audible switching noise with the LAP-2.V3.

3.0 Safety of operation :

The device is designed for users who highly care for stability of audio parameters throughout the whole period of device operation.

Fault-free operation of device is ensured by active switching matrix with use of additional buffering amps. If you overload an input in any normal audio amplifier, it is possible to damage the input circuit and so the session is ended. Now your amplifier need tot be repaired. If you damaged one input of the LAP-2.V3, the other 5 inputs will work continuing because the summing amplifier as whole will not stop working. May be your session likewise goes on.

In case of turning the device off or sudden power disruption the input choice and levels are memorized and restored at next power on of the unit. That function is also useful for users, who work with timer type power steering devices.

4.0 INPUT SELECT and MUTING FUNCTION :

Analog monitor operation :

Central section of LAP-2.V3 are two stereo routers (Monitor-Router and Record-Router). **Monitor router** serves for switching signals that are to be monitored or turns them off completely.

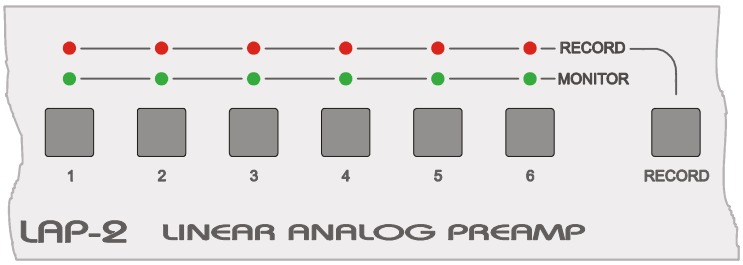
Analog record operation :

RECORD ROUTER enables choice of signals to be recorded and works independently from choice for monitoring. The signal appears on all the CINCH outlets and enables simultaneous copying on multiple devices without need for using Y–cables or any other crossing board.

DIGITAL AUDIO SIGNALS :

LAP-2.V3 works only with analog signal sources. If digital sources are to be monitored, recorded and/or split, optional digital switch **CAS-2.V3** matched to LAP-2.V3 enables selection of one of 8 **digital signal sources** and routing it to external digital-analog converter. Besides, the CAS-2.V3 can choose any signal from 8 inputs as record signal and route it to any 5 record outputs.

4.1 SIGNALS SWITCHING\MUTING :



Analog signal source is chosen by depressing one of input selectors - **INPUT 1..6**. Former input selection is then replaced by the new choice.

Turning off the monitor signal: to turn the monitor out press and hold input selection button for at least 1 second. The LED lamp above this button will be dimmed. This will show the output mute function is on. Headphone out is still active, though, and choosing the signal source is still possible.

Turning the monitor signal back on: to turn the monitor output on press and hold the appropriate input selection button for at least one second. The LED lamp above this button will go back to normal brightness and the output signal is back on.

LAP-2.V3 features both analog monitor matrix and recording matrix. Thanks to this one of the signals fed to inputs 1..6 can be chosen and used as signal source for recording onto external recording device. This happens independently from currently monitored signal. By depressing „RECORD" button and simultaneous choice of analog source (1..6) the **RECORD MATRIX** becomes active and switches chosen signal to all recording outputs. Green LED diodes indicate selected monitor source, red LED diodes indicate record source (blue or white LED diodes are standard with chrome or gold plated front panels. In case of other front panels colours can be custom-ordered). White diodes are optional possible to order in all versions.

To turn on record signal: push right button **Record** and simultaneously depress one of input select buttons. Signal source will be turned on and indicated by Record LED diode.

Turning off the record path: push simultaneously and hold for at least 1 second right button Record and one of the input choice buttons. The LED diode Record will go off and record path will also be turned off.

Brightness of LED diodes adjustment: Brightness of LED diodes can be adjusted by small potentiometer placed inside the unit.

5.0 CONNECTIONS :

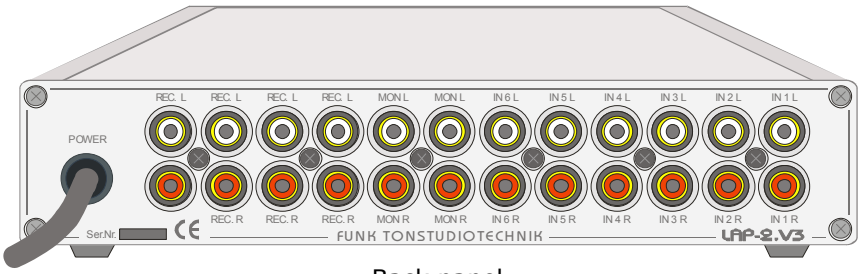
Inputs : 6 analog asymmetric stereo inputs (RCA sockets). Working level of signal is 0 dBu, input impedance 2 MΩ. Also very high level signal sources of up to +25 dBu, as commonly seen in professional devices, will be reproduced without distortion. For matching levels see also „Matching the levels" chapter.

Outputs : 2 stereo monitor outputs (RCA sockets) for active speakers/subwoofer or power amp. Output impedance : 62 Ω.

4 stereo record outputs (RCA sockets) for recording analog sources. Working level is 0 dBu. Output impedance : 62 Ω.

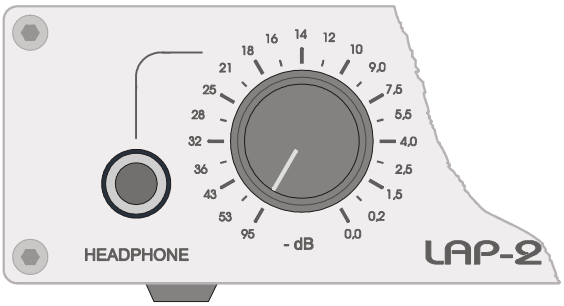
All the ins and outs are gold plated CINCH sockets.

Headphone output : LAP-2.V3 features efficient stereo headphone amplifier for use with passive headphones.



Back panel

6.0 HEADPHONES



The integrated headphone amplifier can work with both lo and high impedance headphones with 6,3 mm stereo jack. Headphones out is easily accessible on front panel of the device.

The Headphone amplifier of the LAP-2.V3 can drive passive headphones with range of impedance from 8 Ω...10 kΩ. Optimal impedance for headphone is between 70...600 Ω. Comparing to former version (the LAP-2.V2) power of headphone amp has been increased by 80 %. Depending on impedance of connected headphones it is approximately 265 mW per channel. Due to internal current limitation, the power of the amp is lower with lower impedance of headphones. Maximum available power with respect to impedance is showed in table below (output power at THD less then 0.1%)

600 Ω	300 Ω	200 Ω	150 Ω	100 Ω	70 Ω	47 Ω	33 Ω	22 Ω	16 Ω
2x 200 mW	2x 265 mW	2x 250 mW	2x 235 mW	2x 140 mW	2x 100 mW	2x 60 mW	2x 36 mW	2x 25 mW	2x 18 mW

Attention ! With use of certain types of headphones, depends from impedance, the loudness of the headphone output can become quite high. In order to avoid hearing loss turn down the volume knob before changing signal source and/or headphones.

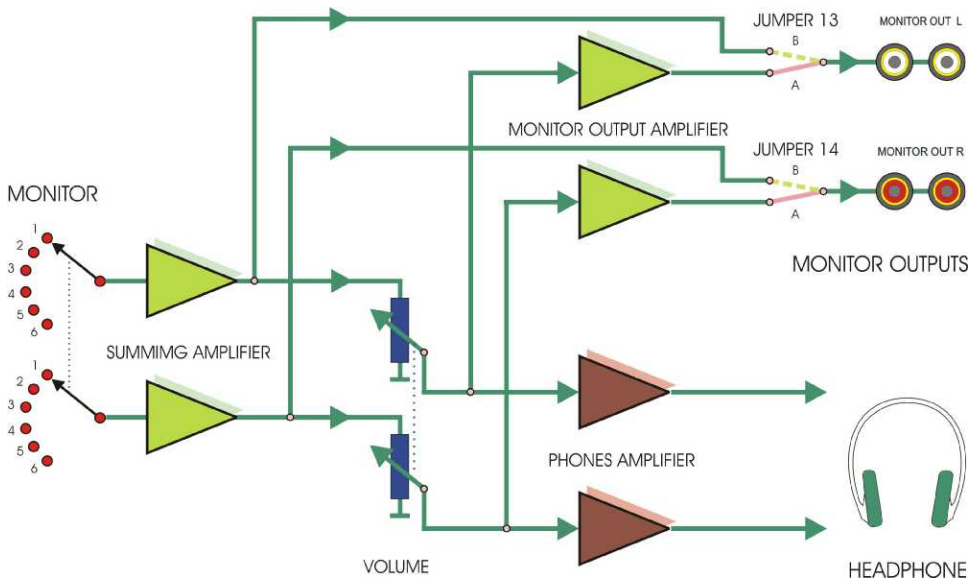
6.1 VOLUME

Level of headphone signal is set in dB and is common for both headphones and monitor. The knob has 21 step positions and therefore it is easy to recall previous setting. This precise and resistant to wear potentiometer also enables settings between 2 step positions. The range of adjustment is between 0..-95 dB. In typical work range 0..-40 dB uniformity deviation between both channels is less then 0,5 dB.

For special use with constant level of monitoring the **LAP-2.V3b** version is available. Monitor level is independent from the level knob position, just like record level. Level knob position change brings only gain change for headphones. In this version monitor level can be adjusted with external stereo amplifier connected to one of the outputs. This version makes sense for those users, who want to use the device only as signal input extension for their existing amp.

6.2 MODIFIKATION

LAP-2.V3a can be easily upgraded to version LAP-2.V3b without need for soldering. As it is showed on diagram on the right, this is done by moving two jumpers on the right side, beside potentiometer inside the unit (jumper J13 and J14). In **LAP-2.V3a** the jumpers are in position „A", in **LAP-2.V3b** they are in position „B".



6.3 PROCEEDING

Turn off the LAP-2.V3. All the Cinch cables and power cord connected to the back panel can remain in place. Loosen 4 hex key screws on the front panel (wrench size 2,5 mm). Remove the front panel and then remove upper cover. Set both jumpers J13 and J14 to position „A" or „B". Assemble the unit in reverse order.

6.4 LEVEL CONTROL

For level control in LAP-2.V3 special mechanical precision regulators are produced. In comparison to cheap, digital level regulators they offer much less distortion during low level signal pass, which is particularly notable with 16 bit systems.

Quality of signal in case of using digital level regulators

Purely digital level regulators can be recommended only for limited range of application, especially regarding low level monitoring and typical 16-bit formats. At digital fader level of about -20 dB an average signal level will stay around -30..-40 dB (depending on the program content). However, the basic noise level will remain approximately the same, regardless of gain level. In consequence, the dynamic range falls roughly in proportion to preset signal drop. In case of sources with typical 16 bit resolution the dynamic range will be limited from 98 dB (at best) to about 58..68 dB.

The real problem lies in non-linear distortion, though (THD), which rise significantly during digital signal lowering. In given example, distortion rise typically by the factor of 10. Moreover, in quieter places on CD, where level is around -20dB, the non-linear distortion rises once more to ten times greater value. An analog-digital converter, which has THD of around 0,005% at full level, then exhibits the level of THD at as much as about 0,2..0,5 %. This distortion is still very prominent at higher harmonics (k3..k9), which excludes listening to music at very high fidelity. At higher bit depths like 24 bits the problem is drastically reduced.

Analog electronic level controllers are often used with VCA (Voltage Controlled Amplifier) amps. Their main flaw is limited dynamic range and relatively high distortion when compared to high quality audio electronics. The flaws occur mainly at high level difference between input and output of level controller and they contain second and third harmonic, depending on the circuit method.

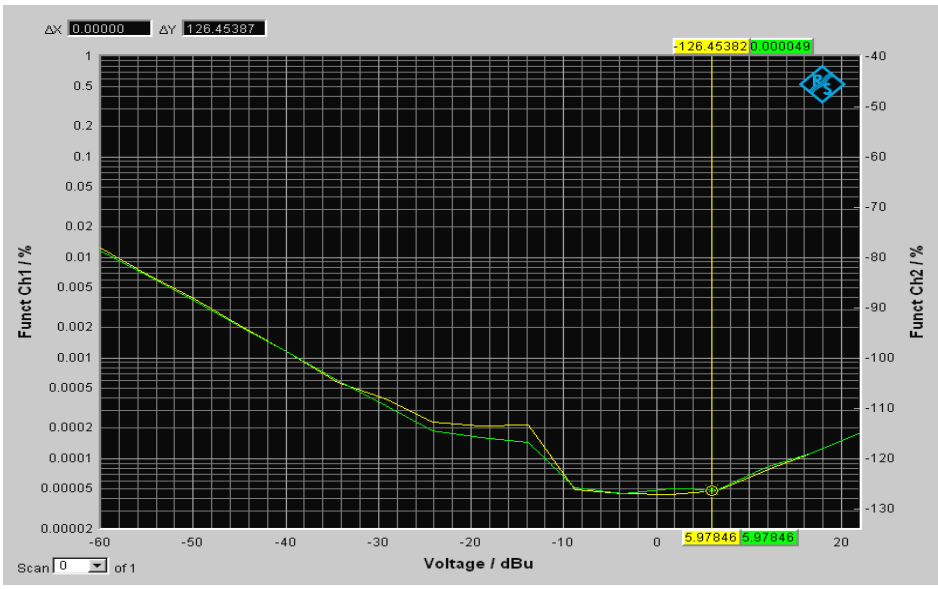
Like digital level circuits separate level controllers with electronically operated integrated circuits, which will not be realized in D/A converter, usually have no problems with uniformity of operation. In simple circuits and at higher level however, Second Harmonic distortion occur quite often. Also, dynamic range potential and level resolution will be limited in too high degree.

Why analog level control ?

Passive analog level controller of LAP-2.V3 fundamentally does not have this problem. Also at lowest monitoring levels, as in the case described above, it is impossible to notice any significant limit to resolution. It depends in decisive degree, though, on amplifying path's after the level adjusting potentiometer. There exist potentiometers, which total internal resistance does not have purely Ohm nature. It is capacity and inductance factors, which cause measurable nonlinearities often.

A big problem is tracking linearity response in stereo potentiometers. Tracking nonlinearities of 2-3 db are not uncommon, especially at lower level settings. Higher quality pots ensure typical error of 0,5..1 dB in the nomal working range from -40..0 dB.

For level adjusting pots often too high values of resistance are designed, which can cause additional noise components. Impedance of values 50...100 kΩ or more, which is often seen in Hi-Fi equipment generates too much of own thermal noise. This can limit the maximum possible dynamic range. Additional, these high impedances enabled higher distortion in the following amplifier stage through there non-linear input impedance.



This diagram shows typical, exceptionally small nonlinearities separately for both channels. The data are for amplification 1 [0 dB] (amplification in right full position [cw]) and various input levels of LAP-2.V3. Bottom scale shows the level, right and left scale shows corresponding THD distortion calculated from harmonics k2..k9 in % (left) and dB (right). In amplification range between -10...+14 dBu the THD for both channels lies below 0.0001%! Even signals at -60 dBu, which correspond to the quietest, almost inaudible places in recordings of symphonic orchestra, total THD is less then 0,015%. Minimum lies at input signals of +6.0 dBu (about 1.55 Volts, a studio standard for full gain), marked by cursor, at value of only 0.00005% (-126 dBu). In digital audio devices such values are not obtained in volume circuits till now. For most amplifiers used in HI-Fi such tests offer 1..2 times greater distortion. Even Rhode & Schwarz UVP audio analyzer used here, which belongs to the best audio measuring devices for such measurments, reaches its resolution limits in this test.

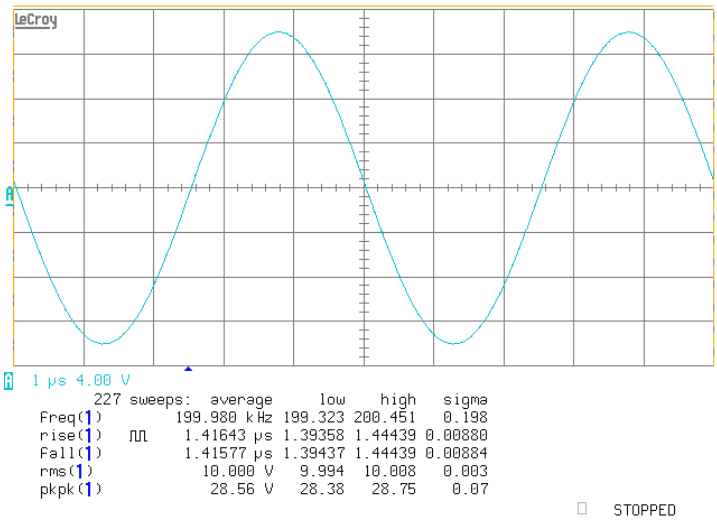
Power stage influence on signal quality

A lot of care and much work were done into design and assembly of the power stage. This ensures that even least noise that can be introduced by a power stage is completely eliminated. The integrated power stage produces exceptionally stable and clean electric current (at full load noise and hum coming from power stage are below 50µV!). Digital control system have own power supply and, in major degree, own leads. „Ultra-Low-Drop" circuits for all supply voltages produce only very small amount of heat (Ultra-Low-Drop = exceptionally low voltage and current losses between input and output of voltage stabilizer circuit). Contrary to many other designs, the LAP-2.V3 uses only small amount of energy, equal to about 4.5 W. Besides the environmental protection aspect, it has positive influence on longevity of the device.

6.5 AMPLIFICATION PATHS :

The LAP-2.V3 has typical frequency response of below 1Hz...1 MHz -3 dB. Therefore even very short impulses of signal with high amplitude will be cleanly reproduced and will not press the LAP-2.V3 to its speed limit. Thanks to very fast amplification stages the transient inter-modulation distortion is practically non existent.

Test signal picture 1: High signal frequency response of LAP-2.V3. Sinusoidal signal of 200 kHz at level of about 10 V RMS or 30 Vpp (corresponds to about +22 dBu gain level). Even sound signals of highest level and frequencies much above human hearing possibilities are reproduced by LAP-2.V3 without any shape alteration. This diagram curve shows, that preamplifier can be an ideal match for newest digital sound sources, which work with sampling frequencies of up to 192 kHz and beyond.

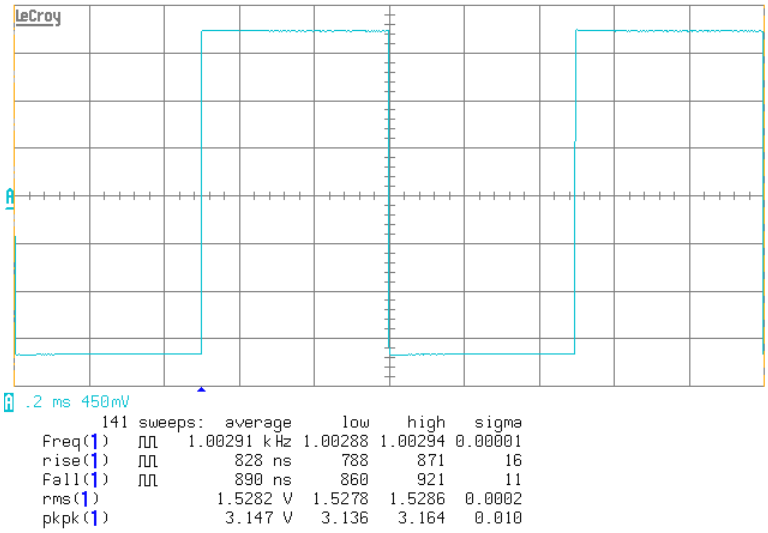


Amplification paths:

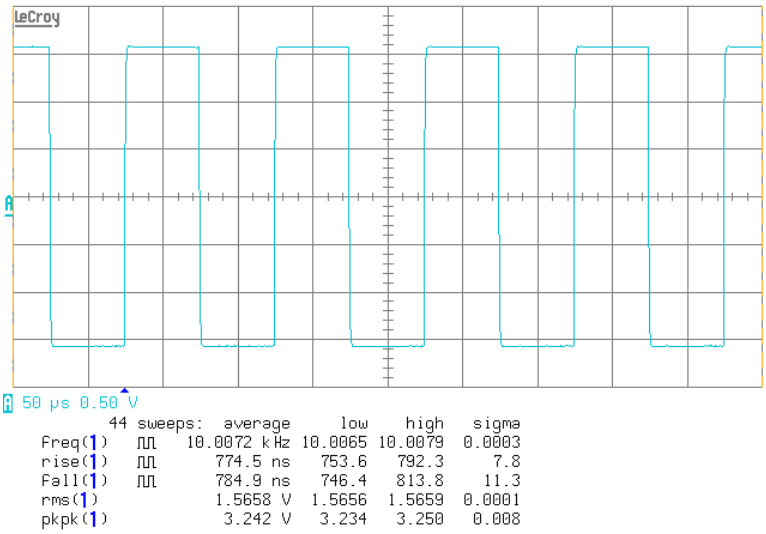
LAP-2.V3 is equipped with very wide band amplification stages, which ensure exceptional and super stable reproduction of signals and its phase. This clearly proves the following measurements. LAP-2.V3 is driven at 0 dB gain (input signal voltage = output signal voltage) and the source signal is square wave impulse generator. Output signals are recorded with fast, laboratory standard oscilloscope connected to monitor output of LAP-2.V3.

Limits resulting from narrow frequency response due to phase shift of tested device are visible for example as irregularities in transition from vertical to horizontal direction, or oscillations on horizontal parts of wave line diagram.

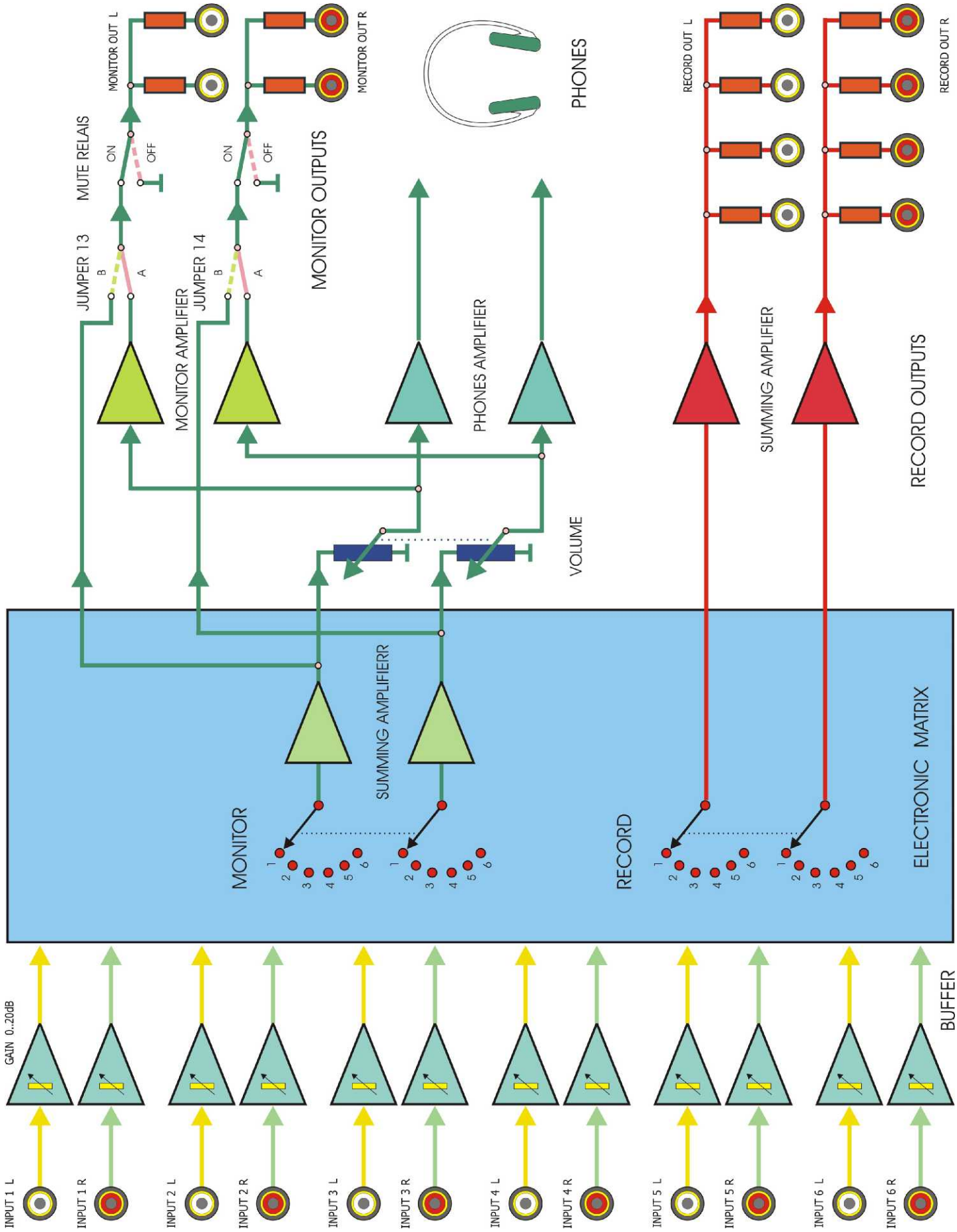
Test signal pict. 2: 1 kHz at level of about 1,5V RMS (corresponds to +6 dBu gain level) with typical load impedance of 10 kΩ. Almost invisible slants indicate wide frequency response and phase coherency in bass range and clean reproduction of even lowest bass impulses.



Test signal pict. 3: 10 kHz at about 1,5V RMS. Oscilloscope load resistance in this measurement is 300 Ω. Very steep vertical slopes indicate wide frequency response of the LAP-2.V3 in high frequency region. Even the fastest impulses will be precisely reproduced!



LAP-2.V3 BLOCK DIAGRAM



6.6 CREATING INSERTS :

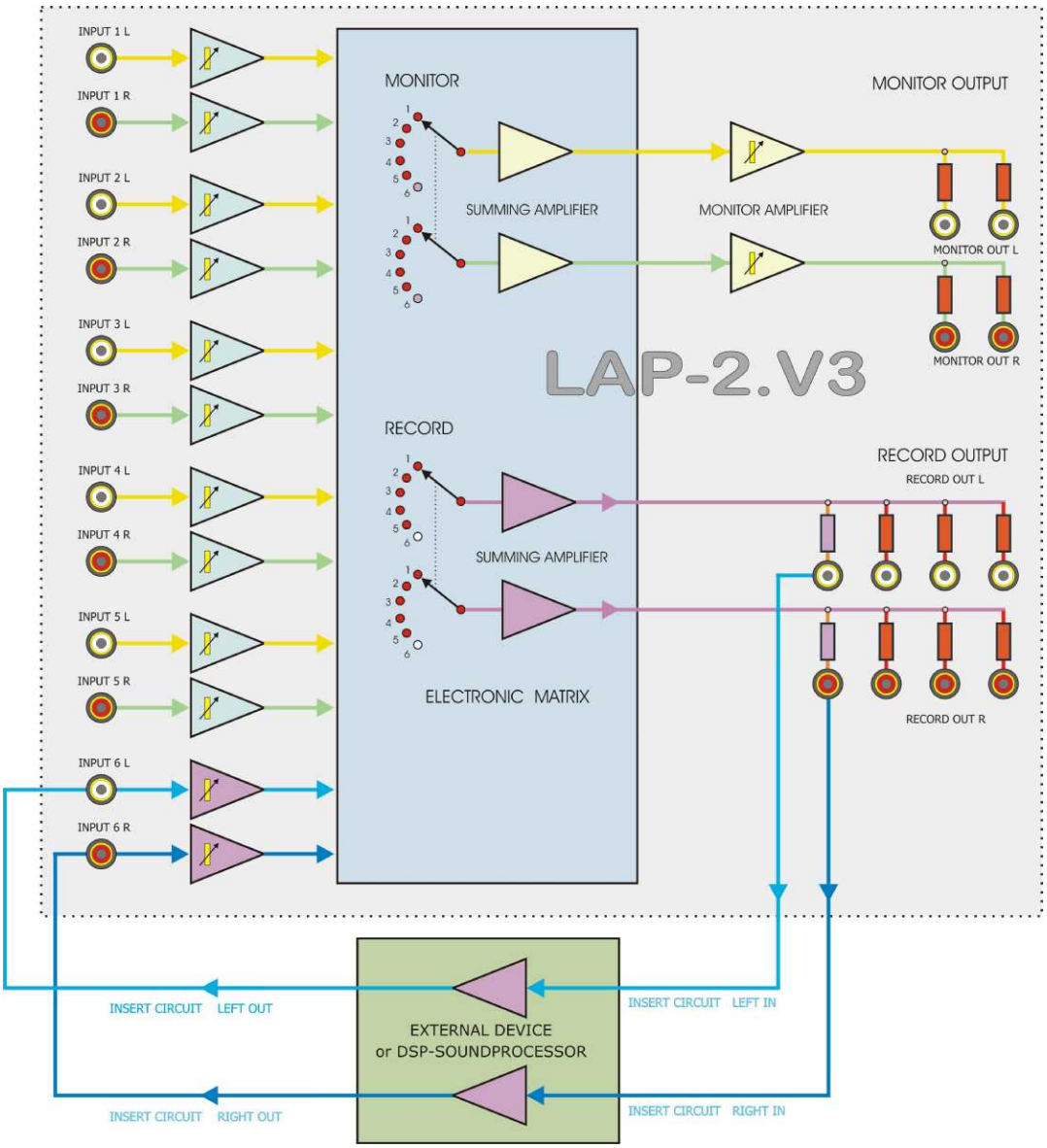
LAP-2.V3 does not have INSERT input/output for external devices for optional use with monitor path. However, this function can be created (with small limitations) for monitor path as long as only up to 5 inputs of LAP-2.V3 are used and recording path is temporarily not used.

Picture below shows example of connecting external sound processing device. Inputs 1...5 are normally used inputs for 5 different sound sources. The 6-th input is used for output signal loop of the device (such as sound processing or DSP FX-type device). Input of external device will be fed by any Record-Out of LAP-2.V3, just like it is shown on the picture. Signal path for the external device is shown in blue or purple. Attention: Input 6 can not be used in record path then!

6.7 INSERT SETUP :

To choose signal for the external device used as loop press simultaneously Record button and selected input button. The 6-th input will serve as monitor for any signal passed through connected external device.

Example : if, let's say, a CD player connected to input 2 of LAP-2.V3 is to be monitored both dry and processed by the external device, then button 2 should be pressed for record path. This way CD player's signal will be fed to external device's input. Signal changed by the external device can be monitored by switching monitor path from button 2 to button 6. Pressing the button 2 will cause dry signal pass from the CD, pressing button 6 will pass the signal through the external device.



6.8 HOW TO SETUP „ADJUSTED RECORD PATH" :

Normally, the LAP-2.V3 does not have level adjustment for record outputs to feed external recording devices.

This function, however, can be created with small limitations, for monitor path if only 5 inputs are needed and common volume adjustment for monitor and record path is not an obstacle.

Below picture shows an example of connections for **LAP-2.V3**. Inputs 1...5 will be normally used as inputs for 5 devices. 6-th input is connected with monitor output signal. This additional signal path is shown in blue or purple. Input 6 can not be used then for monitor path!

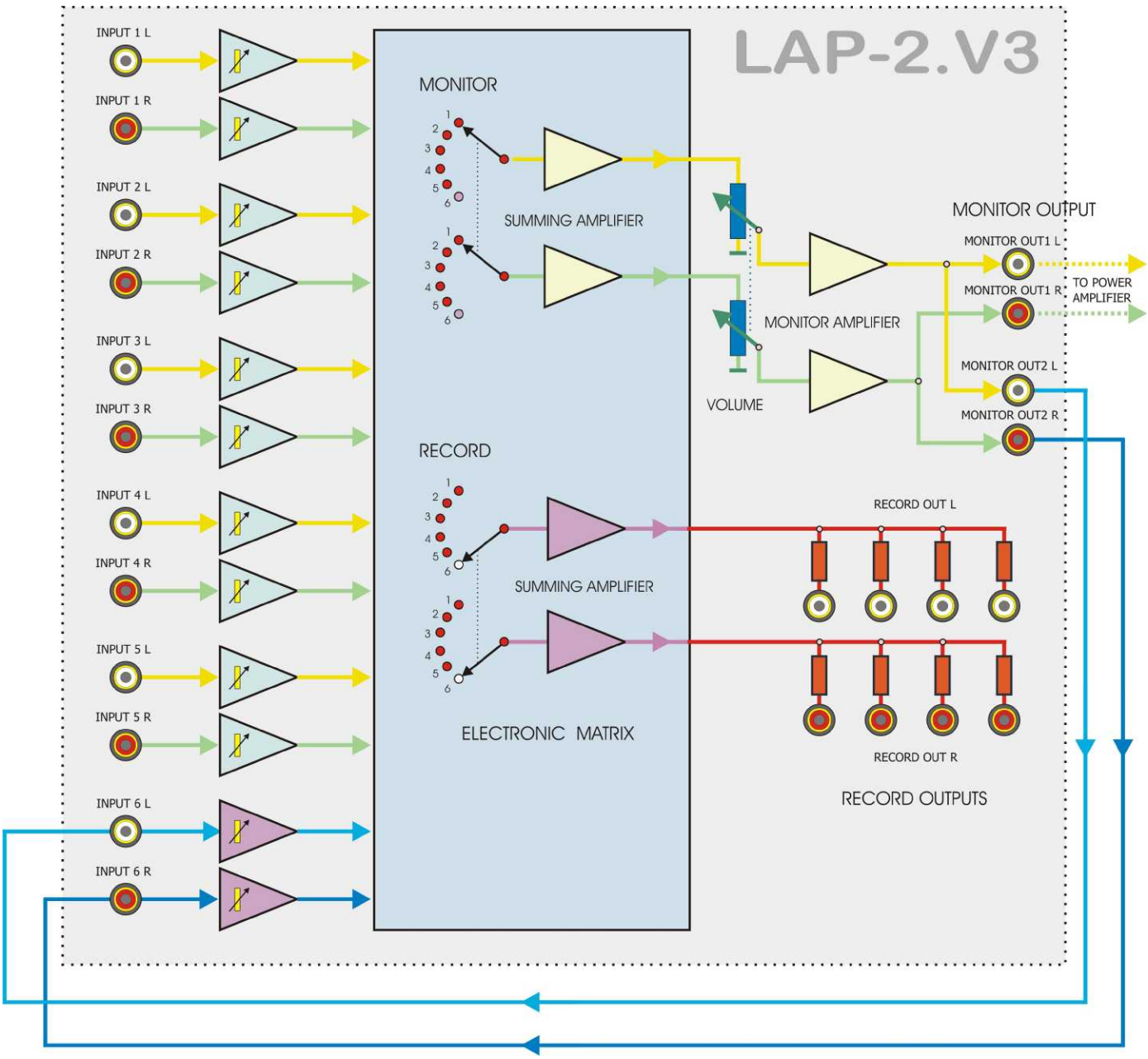
6.9 OPERATION MODES :

For record path input 6 will be selected. In order to enable it press right button "Record" and button for input 6 simultaneously.

Now, Signal for recording is chosen with input buttons 1...5. Final monitor level in this operation mode will be set on output device like amplifier or active speakers.

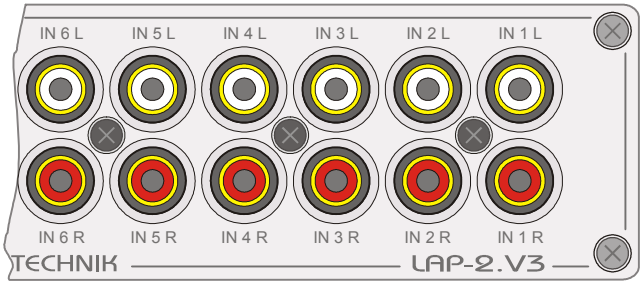
To turn off this mode of operation just press right Record button and, simultaneously, source input button 1…5.

Audio Block Diagram without phone amplifier and power supply



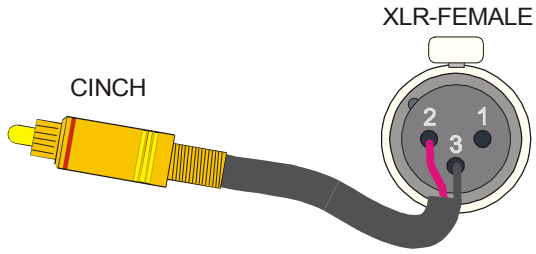
7.0 CONNECTIONS

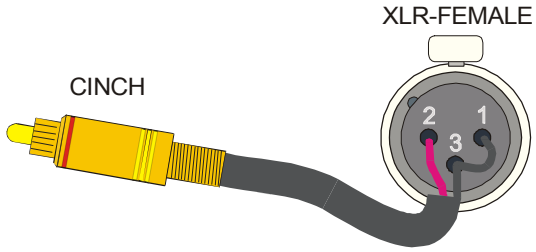
7.1 ASSYMETRICAL ANALOG INPUTS/OUTPUTS



Cables used with inputs and outputs of LAP-2.V3 should have shield soldered to Cinch plug chassis. Besides, attention should be payed in order to avoid loop noise effect caused by other connected cables or between various stacked devices (ground loop effect). See also *„INTERFERENCE EMISSION and RESISTANCE TO OUTSIDE NOISE SOURCES"*. We recommend using plugs for unused input ports with bridged signal and ground wires. AS-75-Cinch-Connectors with 75 Ohm resistor between Signal and ground are suitable.

7.2 SYMMETRICAL RECEIVERS (active speakers or power amplifiers equipped with XLR inputs)





If asymmetrical outputs of LAP-2.V3 are to be connected to a device with symmetrical inputs the picture beside shows optimal connection configuration (shield on pin 3). If ground connection between the LAP-2.V3 and active speakers or power amps already exists, e.g. via power cords, then small voltages differences will be aligned thanks to differential amplifier properties, if it absorbs common signal sufficiently strong. **No** ground loop, often leading to sound quality problems arises.

If there is no ground connection between LAP-2.V3 and active speakers or power amp, the usually most efficient is second connection technique, shown on picture below. Thanks to connection between pin 1 and pin 3 receiving device has stable ground reference to the monitoring device.

In exceptional situations, when proper playback can not be obtained this way, the solution is to connect intermediate symmetrical amp. In this regard we suggest e.g. SAM-1C or SAM-2B, which are available in many versions. See also chapter „Noise and hum loops".

7.3 WIRING SUGGESTION

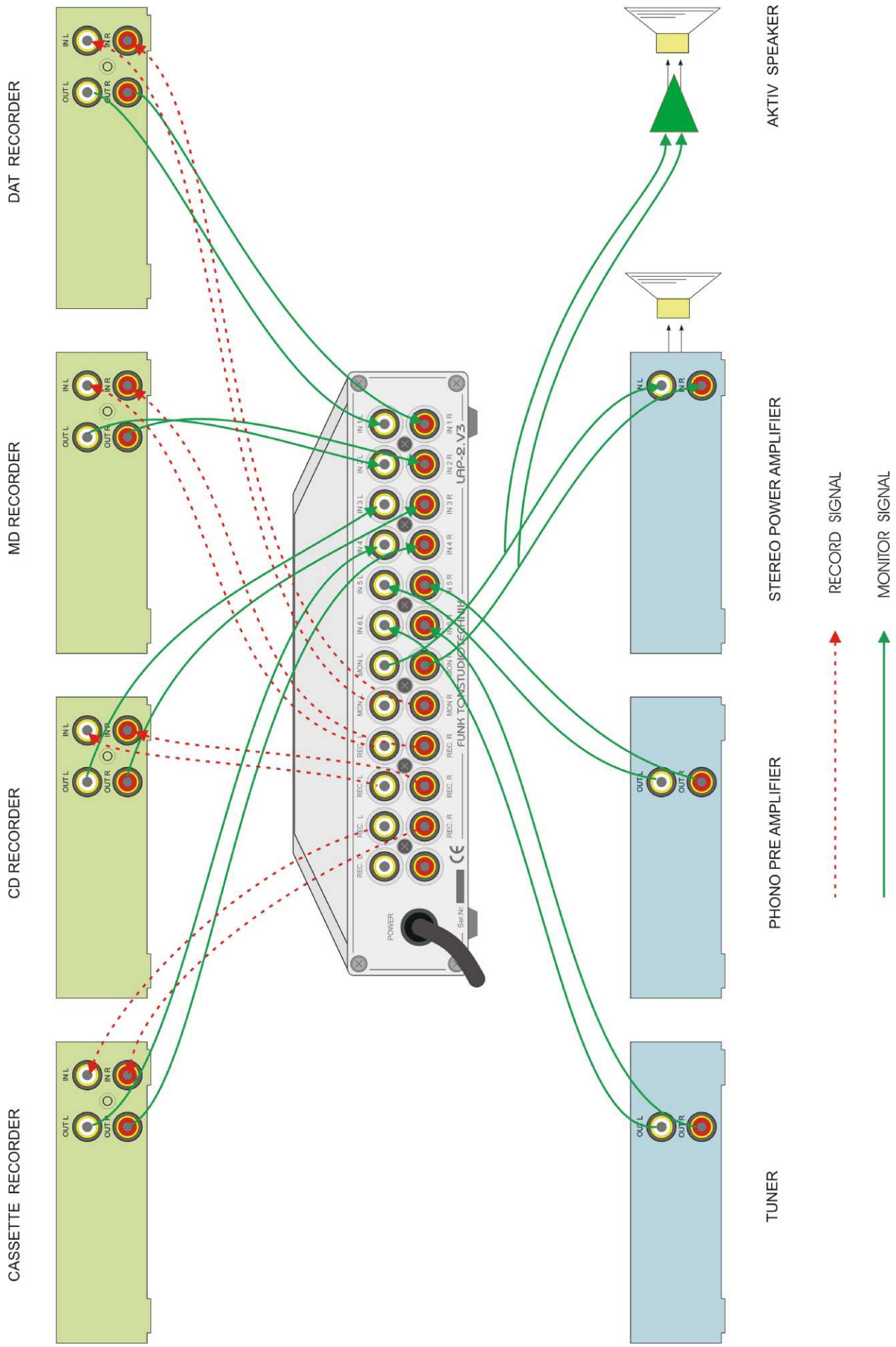
The following picture next side presents an example of typical wiring for LAP-2.V3 and a stereo power amplifier or active speakers as well as 6 additional devices (only analog audio connections are shown). In this configuration copying each source onto each receiving (recording) device is possible.

Each of inputs 1...6 is working well with **all** asymmetrical analog hi output signal sources equipped with Cinch port (cassette tape recorder, phono preamplifier, tuner, iPOD, CD, DAT, DCC, MOD, DAB, Mini-Disk and so on). The same applies to outputs.

In this wiring example power amp can be used for monitoring any of 6 connected devices (lower row of LEDs on front panel indicates monitored source).

Simultaneously, through record outputs, regardless of monitor choice, any signal can be recorded to DAT-Recorder, MD-Recorder, CD-Recorder and cassette recorder (upper LED row on front panel of LAP-2.V3 indicates recorded source).

LAP-2.V3 WIRING SUGGESTION

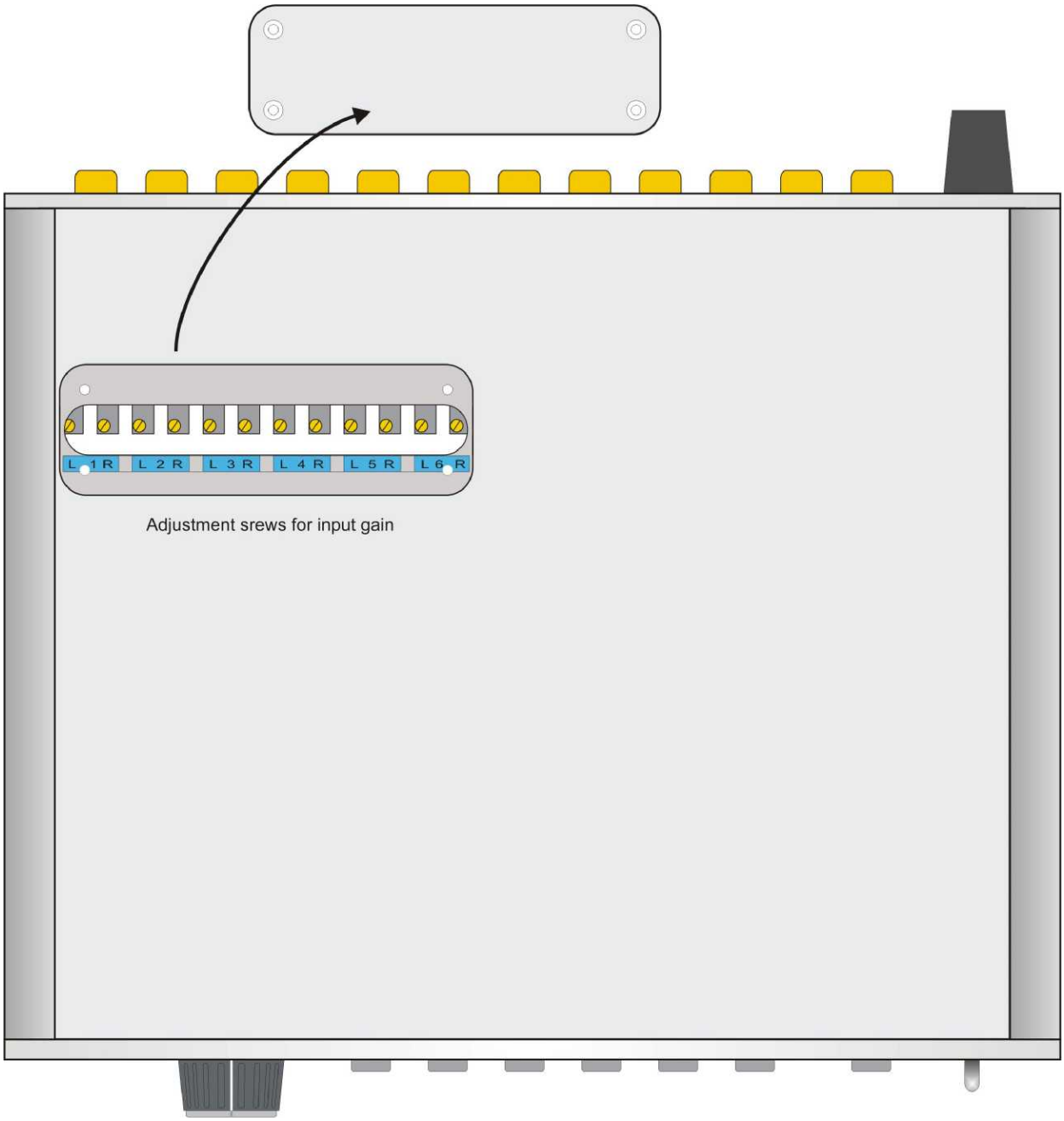


8.0 MATCHING INPUT SIGNAL LEVEL :

If other then factory pre-set working levels will be necessary on asymmetrical Cinch sockets, then it is possible to change sensitivity within certain limits, using 20 turn precision trimmer placed on the main board. A small, removable cover (option) on top of the chassis can be removed by unscrewing 4 small Philips screws size 1 or, depending on version, a hex key screw 1,3 mm. Attention: use care during tightening the small M2 screws in aluminum cover to prevent the fragile thread from damage. As for devices with closed cover: open the device as described in "HEADPHONES and LEVEL" chapter „6.3 PROCEEDING".

Below the window there are 12 gray rotating trimmers, which can be aligned using screwdriver. Only flat tip screwdriver should be used with tip width 2...2,5 mm. Turning trimmer clockwise increases gain. It is possible to set gain between 0 dB..+15 db.

At factory the LAP-2.V3 is set at 0 dB gain. Fully counterclockwise position is roughly standard gain. To prevent damage to trimmer tip during turning, tip of the trimmer is blocked by groove. Setting trimmer above this position does not influence gain, but does not damages the trimmer.



View from above, version with gain adjustment lid.

8.1 OUTPUT LEVEL :

Output level of LAP-2.V3 and other amplifiers depends on used signal sources. Best suited are those devices giving such strength of signal that level knob of LAP-2.V3 at highest required volume settings stays between 12 and 3 o'clock position. If the high volume is reached earlier, we recommend matching levels in power amp or active speakers. In this regard we offer special dim cable **DKS** which will be specifically matched to your device.

This level matching cable enables proper match of hi output sources such as preamplifier or other analog signal sources to especially sensitive inputs of power amp or active speaker systems. The matching cable should be used when at highest volume required the volume knob is far from right maximum position. The feed level should be lowered by muting cable if there is 15 dB or more of additional gain when turning the volume knob fully clockwise and the monitor level is already very high, at maximum required level.

The base noise along with interference in the cable will be lowered, accordingly to strength of signal. There is benefit of increased usable dynamic range. Besides, the volume knob works in its optimal range. This gives more linear level adjustment and also better level resolution at lower volume.

In case of analog recording devices of too high input signal sometimes there is a need of setting the level knob in vicinity of 9...10 o'clock position. In such cases the DKS cable is ideally suitable. Not only much better characteristics of level knob is obtained, but also danger of overloading input amplifier is avoided.

Voltage divider in the cable is placed inside the male CINCH plug. Thanks to this cable capacitance has no negative influence on voltage divider of this kind.

DKS cable is delivered as kit consisting of two single cables. Precision metal film resistors are used in voltage divider, so level difference between both muting cables is exceptionally small and typical better then 0,02 dB.

DKS muting cables kit is passive and influences directly the inputs of power stage. Attenuation depends also on input impedance (input resistance) of the power stage. However, input impedance of LAP-2.V3 is negligible. Please state desirable value of attenuation and input impedance of used power amplifier, active speakers or decoder.

The cable is also usable with other brands equipment, as long as inputs and outputs are CINCH type.

Special versions for symmetrical inputs with XLR connectors at receiver side are available.

SPECIFICATIONS :

Attenuation :	6…-30 dB
Input :	Cinch port female
Output :	Cinch port male
Cable length :	about 20 cm
Input Impedance :	typ. 5...100 kΩ (various values possible)
Output Impedance :	typ. 0,1..5 kΩ (various values possible)

9.0 POWER SUPPLY :

LAP-2.V3 has built in new, precise „Low-drop" power supply. This power supply produces exceptionally stable and clean voltages at minimal power consumption and low heat emission, comparing to typical power supplies. Power supply can be loaded up to 250 mA. At higher currents voltage limit will be active and it will lower supply voltage. In case of short circuit between output voltages or ground (± 20V) the power supply will not be damaged.

To avoid damage to connect amplifiers and speakers in case of short-circuit of one power voltage, the power supply is equipped with output voltage symmetry control system. If set border value for symmetry will be only slightly exceeded, for example by overloading one power voltage, corresponding complementary output voltage follows the affected. So the affected amplifier power stages will be turned off. All stabilized power voltages of integrated power supply are short-circuit resistant.

The power supply contains additionally „Power-Down-Mute" system (turns off automatically in case of power supply failure), which controlled the monitor path by relay. Clicks and noises during power on and off are avoided by that, or those existing during turning on signals are eliminated. If one of both audio power voltages of LAP-2.V3 drops down only in minimal degree, this muting relay will be immediately activated. Turn off time is equal to single milliseconds after drop below minimum voltage value, turn on time is about 10 seconds.

The device works with no problem also with voltage fluctuations between 210...245 Volt AC current and between 50...60 Hz. In order to attenuate the power stage interferences the LAP-2.V3 has anti-interference suppressor (Common mode inductor) with additional X-capacitor, so external filters for power stage are usually not necessary. In case of LAP-2.V3 those external power filters bring no sound improvement!

Power supply fuse is situated inside the device. In case of replacement use only fuses 5x20 mm 50 mAt/250V (time delay type). Just in case, please leave it to your local dealer or ship the device back to us, we will help you fast and in competent way.

10.0 BUILT VERSIONS AND ACCESSORIES :

The device is shipped in two power source versions: 230V/50 Hz or 115V/50..60 Hz. Changing power voltage can be done only by manufacturer.

LAP-2.V3 is available in 2 versions of cover. Standard is closed cover. Alternatively, open cover version is available. This enables access to trimmer adjusting for input gain stages of the device. Such cover version is recommended when there is need for fast gain adjustment. Both cover versions are also available as separate parts.

Besides, 2 cover finish versions are available :

1. all cover parts painted in black, sides anodized in black
2. all cover parts painted in white/grey, sides anodized in silver

Front panel is available in various looks, and can be also replaced later by user. Following versions are available: white coated (RAL7035), anodized in black, blue, ruby coloured, silver, shades of gold, as well as special version with gold or chrome plated front panel, which is made of brass.

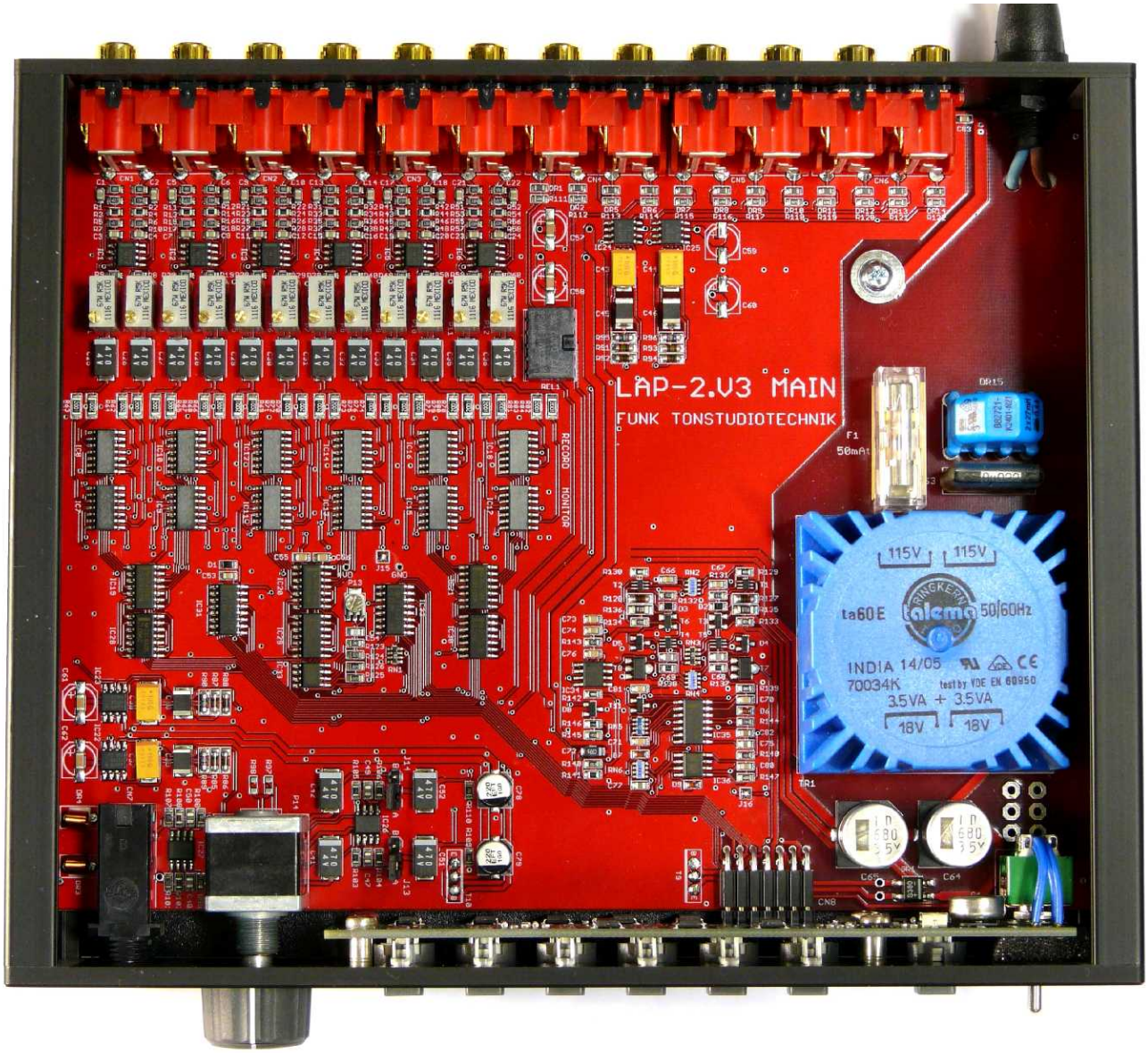
LAP-2.V3 is shipped as monitoring amplifier with common adjustment of headphone and output paths as standard. For special use it can be delivered as **LAP-2.V3b** with fixed monitor output level, similarly to record path. Pair of jumpers inside of the device can be repositioned by user at any later time, in order to turn on this function (see also chapter „Headphones and level knob").

Special version of "LAP-2.V3 MR" with coupled selection of monitor and record path is available as option. Monitor signal is then available on monitor output (dependent on volume knob) and simultaneously on record outputs with fixed, independent level. Each chosen source signal can be routed to record outputs, e.g. can be controlled by a level meter or routed to another device. Phones are dependent on Volume.

This LAP-2.V3 MR version is beneficial for use with level metering. So the meter will be connected to Record out and monitors all selected signals independent from volume control.

INTERIOR VIEW LAP-2.V3

Inside view onto audio main board with cover removed



11.0 NOISE AND HUM LOOPS :

Hum and noise are often generated not only as result of interference with electrical or magnetic fields. Differences in ground potentials between connected devices e.g. Due to double ground connection, so „noise loops" come to existence. They can cause significant interference currents, especially when low impedance shields are used for connecting the devices. Those currents depending on system configuration generate noise voltages which adds to already distorted audio signals. This can be prevented by using symmetrical connections.

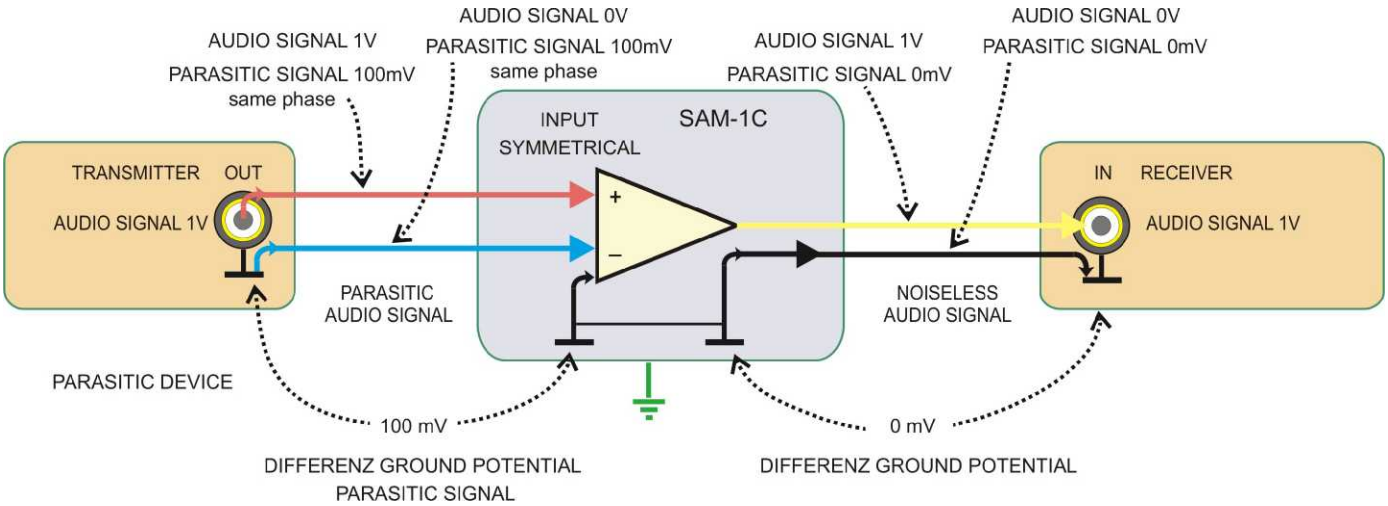
11.1 Noise loops in assymetrical audio circuits:

Real problem solution lies only in splitting this ground connection (loop) and use of audio transformer or differential amplifier.

On picture below influence of separation within the noise loop asymmetric intermediate wiring is shown by connecting symmetrical intermediate amplifier input (differential amplifier e.g. SAM-1C or SAM-2B).

Differential amplifier or hi-ohm „instrumentation amplifier" ideally take into account only the difference between the two inputs. If both inputs are connected to each other and then modulated, no signal will arise in this way at the output. If only input minus - will be connected to ground or to shield of sending (feeding) device and then input plus + to hot input of the signal output, both symmetrical inputs of receiving device will be modulated common phase with interfering signal 100 mV. Input signal, however will remain equal to 0 Volt, because there is no electric potential difference between input + and -.

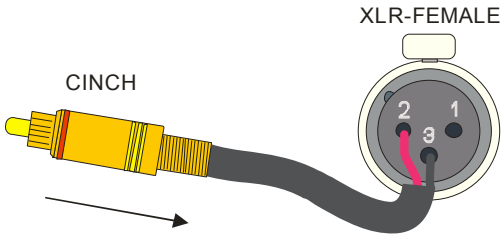
If then sending device's output with amplitude of 1V will be modulated, difference of 1V will still exist on symmetrical input of SAM-1C/SAM-2B, but without hum voltage. This rule also applies when the two cores (blue and red) will be exchanged with each other. Only phase of the audio signal would be changed by 180°. So compensation of phase reversal is also possible.



No differential amplifier works ideally. Typical circuits reach about 1/100...1/10 000 (40...80 dB) of interference signal suppress. Therefore small remains of interfering signal can be observed in output signal of differential amplifiers. Thanks to careful design, laser tuned circuits and instrumentation amplifier technique in SAM-1C/SAM-2B devices, symmetrical interference attenuation has typical value of 1/300 000 (110 dB). In our example it is more by 0.3 µV (~ - 130 dB) in comparison to outlet current, and so below the base noise of most devices.

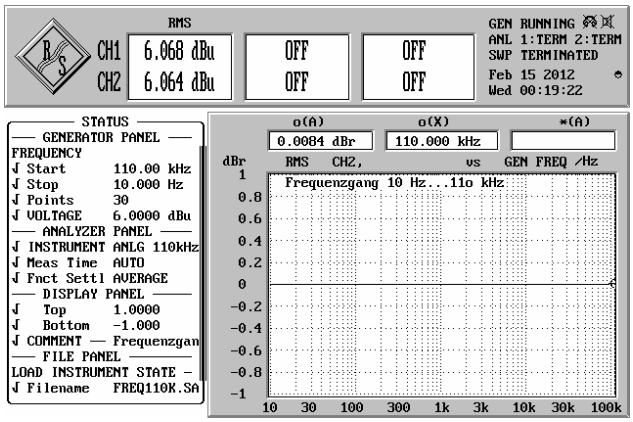
In SAM-1C/SAM-2B chassis (ground or protective cable shield) and zero of circuit are isolated from each other, so they do not create danger of becoming noise loops.

Picture to the right shows practical way of connecting signal sources containing interference with symmetrical input of SAM-1C/SAM-2B. XLR Pin 1 remains open here, and pin 3 is connected to shield.

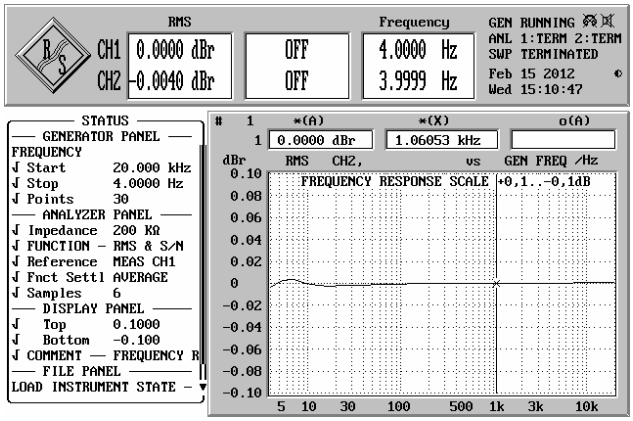


Technical parameters (typical measured values)

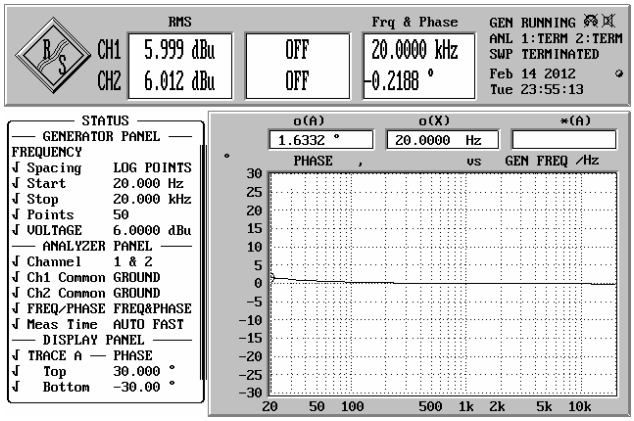
Typical values below are measured using serial LAP-2.V3 on monitor output with typical resistance load of 10 kΩ at signal level +6 dBu and 0 dB gain (almost right maximum position of level knob, input trimmers also at O db), unless otherwise stated. Signal supply by Cinch socket. The exact configuration of the analyzer is given in each case in the left block.



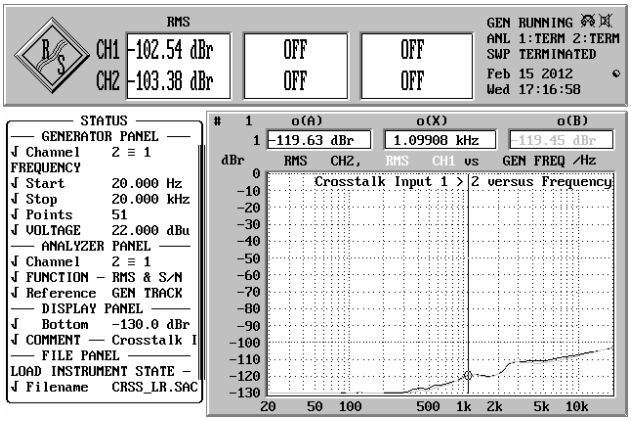
Frequency response monitor 10 Hz..110 kHz Scale ± 1 dB !



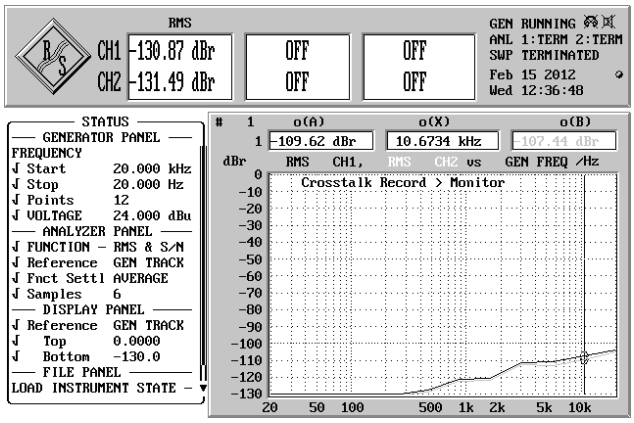
Frequency Response 4 Hz .. 20 kHz Scale ± 0,1 dB !



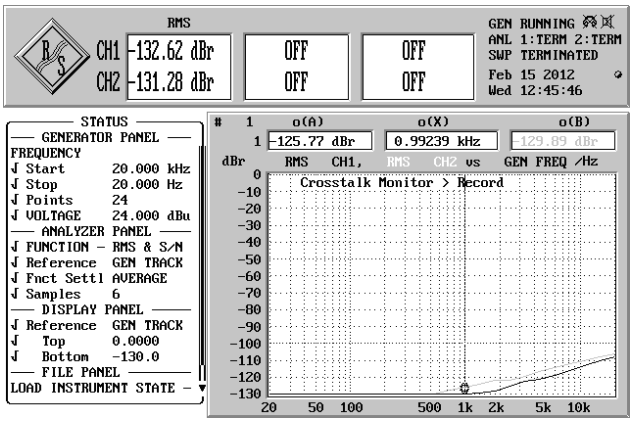
Monitor path's phase response below 2° from 20 Hz... 20 kHz



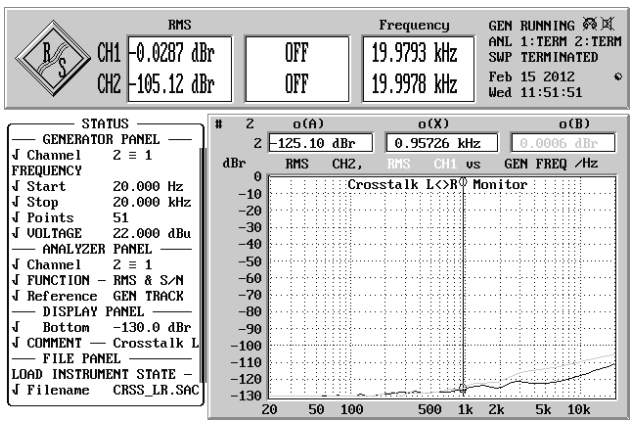
Crosstalk monitor path input 1 to input 2



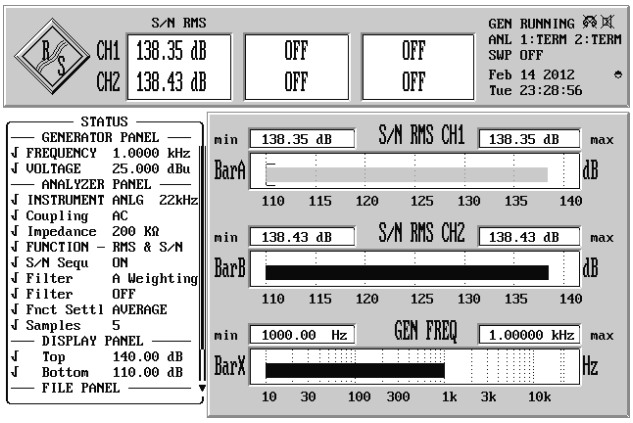
Crosstalk between record and monitor paths



Crosstalk between monitor and record paths



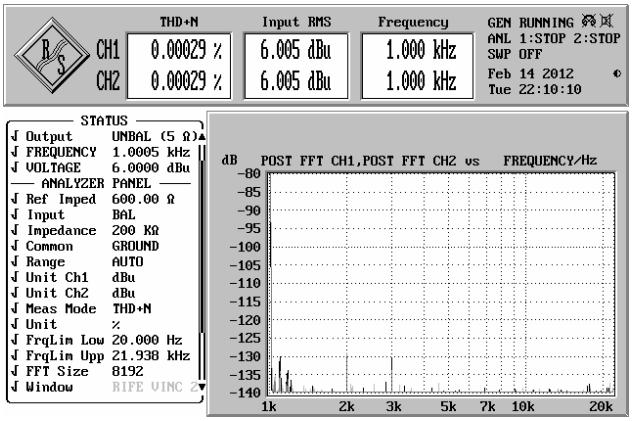
Crosstalk left channel < > right channel



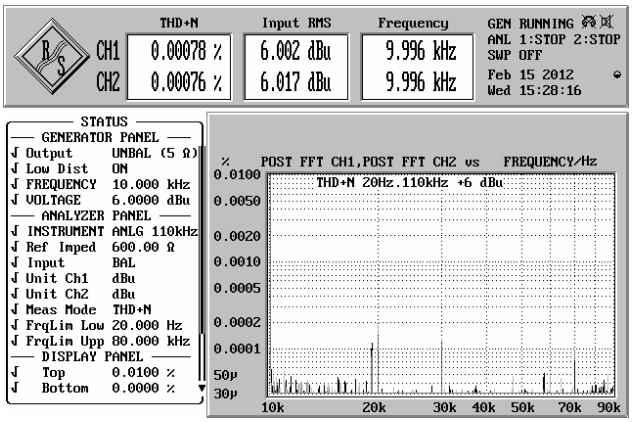
Highest signal level to base noise A-weighting

Technical parameters (typical measured values)

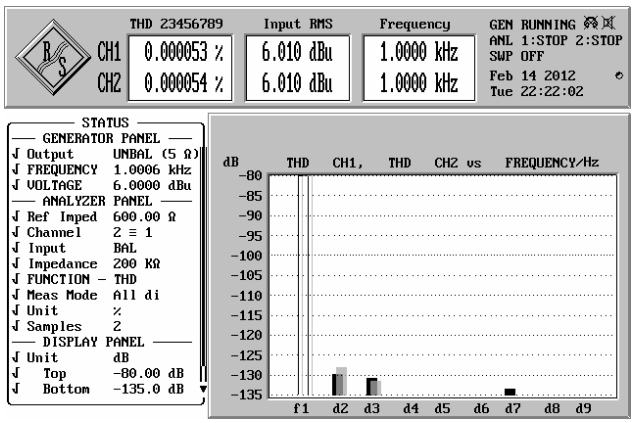
Typical values below are measured using serial LAP-2.V3 on monitor output with typical resistance load of 10 kΩ at signal level +6 dBu and 0 dB gain (almost right maximum position of volume knob, input trimmers also at 0 db), unless otherwise stated. Signal supply by Cinch socket. The exact configuration of the analyzer is given in each case in the left block.



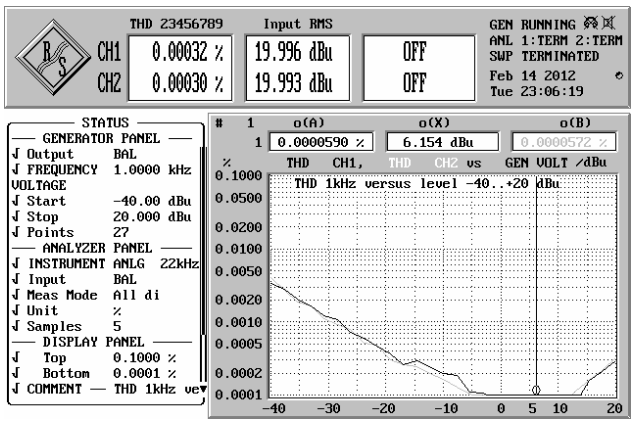
THD+Noise 1 kHz, monitor level +6 dBu (22 kHz bandwidth)



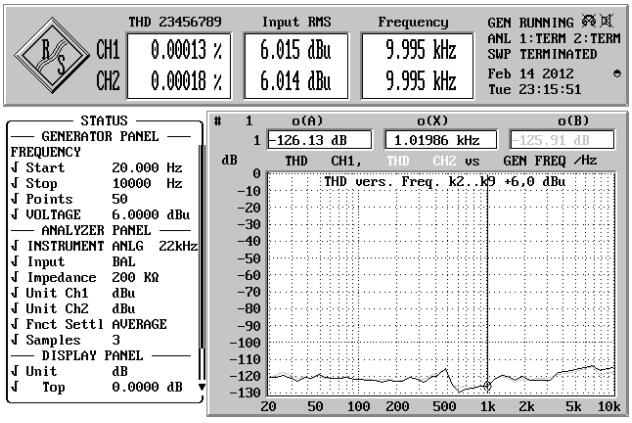
THD+Noise 10 kHz, monitor level +6 dBu (at 80 kHz bandwidth)



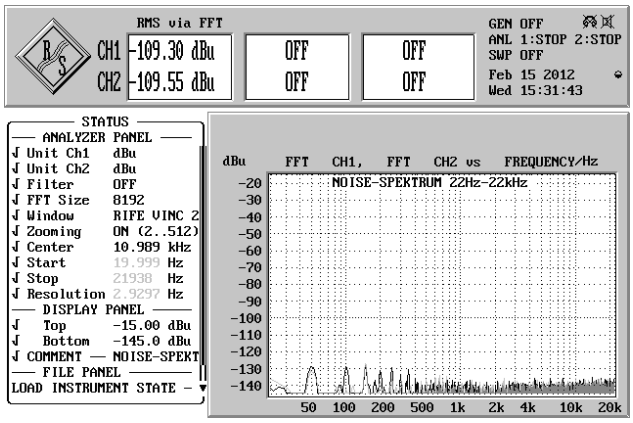
THD at f = 1 kHz and monitor path level +6 dBu



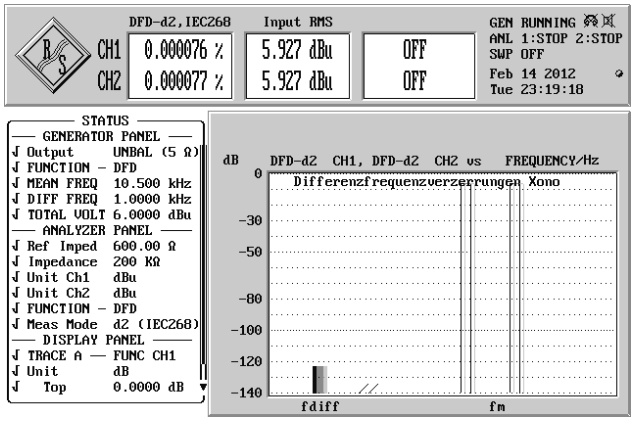
THD at f = 1 kHz input levels -40..20 dBu



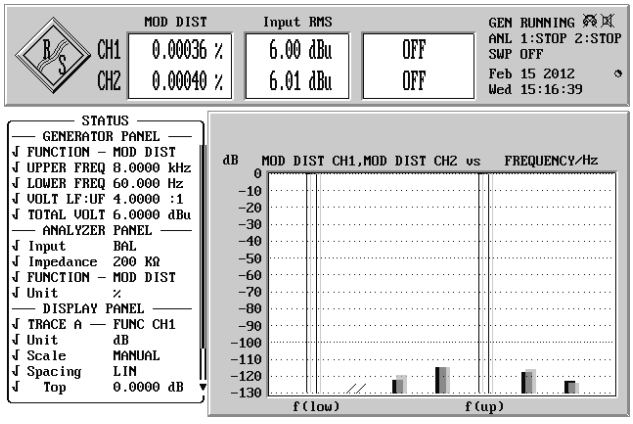
THD at +6 dBu 20 Hz..10 kHz (500-Hz-peak comes from analyzer)



Base noise monitor path volume at full right position



Difference frequency distortion factor at +6 dBu



Monitor path inter-modulation distortion at +6 dBu gain

TECHNICAL DATA LAP-2.V3

Unless stated otherwise, at monitor output, measured at 10 kΩ load, gain 0 db and input gain + 6 dBu, electric outlet voltage at 230V. Values in brackets () are measured at +18 dBu input gain. Audio analyzers used: R&S UPV and UPL as well as Audio Precision 2722 for noise, THD and THD+N measurement

MONITOR and RECORDSIGNAL PATH :

Max. input level:	+ 25 dBu (THD < 0,1%)
Input impedance :	2 MΩ independent from input choice
Input capacity :	15 pF independent of input choice
Max. output level :	+ 25 dBu at 10 kΩ load
Output impedance Monitor :	62 Ω
Output impedance Record :	62 Ω
max. output load :	300 Ω at Ua_{max} +21 dBu, 600 Ω at Ua_{max} +23 dBu
Frequency range :	1 Hz...200 kHz < ± 0,5 dB 10 Hz ...20 kHz < ± 0,01 dB
Low level response :	0,5 Hz...> 1 MHz < +1/-3 dB
Hi level response :	2 Hz...200 kHz < ± 0,1 dB
Absolute phase course :	20 Hz ...20 kHz < ± 2°
Relative phase course left < > right :	20 Hz ...20 kHz < ± 0,2°
Non-linear distortion (THD $_{k2..k9}$) 1 kHz :	< 0,00008 % / <-122 dB typ. < 0.00006 % / <-124 dB (< 0,00020 %)
Non-linear distortion + noise (THD+N) :	1kHz <0,00025 % 10kHz <0,00045 % (1kHz <0,00025 % 10kHz <0,0004 %)*
Non-linear distortion + noise (THD+N) :	1kHz +12 dBu < 0,00015 % / < -116 dB !*
Differential signal distortion 10,5 kHz	< 0,00008 % (< 0,00015 %)
Intermodulation distortion 60 Hz/8 kHz, 4:1 :	< 0,0005 % (< 0,001 %)
Dynamic intermodulation distortion (TIM) DIM100	< 0,0003 % f = 3,15 kHz / 15 kHz (< 0,0007 %)
Crosstalk input/output:	1 kHz > 115 dB 15 kHz > 102 dB
Crosstalk left < > right :	1 kHz > 120 dB 15 kHz > 105 dB
max. amplification input > output :	0 dB (with additional input gain 0...+15 dB)
Gain deviation input/input :	< ± 0,02 dB typ.
Gain deviation left < > right :	< ± 0,01 dB typ. with volume at max.
Level controller setting range :	+ 0 dB ...- 95 dB
uniformity of level controller L < > R (+0..-40 dB):	< ± 0,5 dB
Voltage Noise MONITOR-OUT weighted :	- 112,5 dBu „A“-weighted effective
Foreign Voltage MONITOR-OUT unweighted :	- 109,0 dBu 20 Hz..20 kHz effective (CCIR468-3 unweighted)
Voltage Noise RECORD-OUT weighted :	- 112,5 dBu „A“-weighted effective
Voltage Noise RECORD-OUT unweighted :	- 109,0 dBu 20 Hz..20 kHz effective (CCIR468-3 unweighted)
Dynamic range MONITOR OUT (S/N) :	137,5 dB „A“-weighted effective 134 dB 20 Hz..20 kHz effective (CCIR unweighted)

HEADPHONE AMPLIFIER :

Maximum input level :	+ 25 dBu
Maximum power output :	2 x 265 mW at 300 Ω
Output impedance :	< 2 Ω
Max capacitive load :	5 nF
Output voltage under load :	11,0 V/600 Ω 9,0 V/300 Ω 6,0 V/150 Ω 2,35 V/62 Ω 1,1 V/32 Ω
THD+N Non-linear distortion + Noise:	P_{OUT} = 2x 250 mW at 300 Ω 1 kHz ≤ 0,0003 % 10 kHz ≤ 0,0007 %
Frequency range :	20 Hz ...20 kHz < +/- 0,02 dB
Voltage Noise „A” weighted (gain = 0 dB) :	< -111,0 dBu
Foreign Voltage 20 Hz..20 kHz effective (gain 0 dB) :	< -108,0 dBu 20 Hz..20 kHz effective (CCIR-468 unweighted)

Power supply :	230V / 50..60 Hz (115V 60 Hz available optional)
Power consumption typically.:	4,7 W
Power consumption maximum.:	8,5 W
Protection class :	2
Dimensions :	210 x 172 x 42 (length x width x height without buttons and sockets)
Weight :	1,5 kg front panel gold or chrome plated : 1,65 kg
Chassis finishes :	Steel and aluminum chassis white (RAL7035) or black, side profiles aluminum or black
Front panel version :	white, ruby coloured, blue, silver, shades of gold, anodized black, gold or chrome plated
Warranty :	3 years parts and labour

* Measurement bandwidth THD + N at 1 kHz : 20 Hz..22 kHz, at 10 kHz : 20 Hz...80 kHz

12.0 Interference emission and interference immunity

The device conforms to safety regulations regarding Electromagnetic Compatibility, which are defined in requirements 89/336/EWG and FCC, Part 15 :

Electromagnetic radiation emitted by the device is limited in degree sufficient to using other electronic equipment as intended along with LAP-2.V3.

The device has sufficient immunity to electromagnetic interference, so its operation will not be disrupted by it.

The device has been tested and conforms to following regulations :

Safety : Protection class 1 according to EN60950; 1992 + A1/A2; 1993 (UL1950)

EMC : Audio, video and audio-video installations, as well as for studio lighting controlling units for professional use

Interference emission : EN55103-1
Interference immunity : EN55103-2

Having regard to this standard provides with a specified probability of both environmental protection and reasonable resistance to interference. However, this does not give an absolute guarantee that during the operation of the equipment no electromagnetic interaction will arise.

To significantly reduce the likelihood of such influence, follow these rules:

When installing the unit, follow the instructions in the Owner's Manual.

Shielded cables should be used for all audio paths. Special attention should be necessary to proper, not corroded and large surfaced connection. Cable shield connected only at one end can act as receiving/transmitting antenna.

In the system and the environment in which the device is used, use only the components (systems, equipment), which also meet the requirements stated above.

To avoid creating a noise loop (loop current) or adverse effects, reduction of the surfaces (no unnecessarily long connections) should be used and a reduction of current flowing through them by e.g. using a common mode inductor.

The concept for grounding of a system should be provided that respects both the safety requirements as well as of electromagnetic compatibility.

When choosing between the grounding in a star configuration, or a surface or mixed ones, the advantages and disadvantages in relation to each of the two solutions should be considered

In typical case ground in star configuration in Hi-Fi installations is justified. In case of existing noise loops between interconnected devices, we recommend including symmetrical or differential amplifier (such as SAM-1Bs or SAM-2B).

Noise loops arise also by connecting antenna's ground cable of tuner, computer or receiver, which are electrically connected to audio installation. By including filter into the antenna's circuit (sheath current filter) those problems can be avoided.

12.1 Safety

All repairs, maintenance and other actions on opened device can be performed only by qualified personnel with respect to existing regulations.

Before removing cover the device must be turned off and power cable disconnected from electric outlet.

During repair and maintenance, when the cover is removed and the device is turned on, no metallic (shining) elements can be touched both directly and using non-isolated tool, including metal semiconductors housing.

For maintenance and repair only specific parts that are related to safety and components that conform to manufacturer's specifications can be used.

12.2 Electrostatic discharge (ESD)

Integrated circuits and other semiconductors are sensitive to electrostatic discharge (ESD). Incorrect components handling during maintenance and repair containing such elements can cause change of their features, influence their longevity or lead to permanent damage.

During contact with elements sensitive to electrostatic discharge the following rules should be obeyed :

The parts should be stored and transported only in special and specifically signed wrappings.

Unpacked elements that are sensitive to electrostatic discharge can be handled only in special environment (EPA, e.g. Authorized Service) and can be handled only by qualified service personnel. They should be connected to ground at service station. Device that is maintained or serviced as well as tools, service aids, electrostatic (conducting) working and floor mats must be connected to metal surfaces (danger of electric shock).

To prevent temporary overloading of components and possible damage due to inappropriate voltage or balancing currents, electric connections can be performed only when device is turned off and after discharge of accumulated electric charge in capacitors.

DECLARATION OF CONFORMITY CE

FUNK TONSTUDIOTECHNIK
10997 Berlin

declares in own responsibility that the product

LAP-2.V3

according to directives of UE and their supplements

conforms to following norms :

Safety :

Class of protection 1, EN60950; 1992 + A1/A2; 1993

EMV :

EN55103-1 EN55103-2

Evaluation criterion B of the electromagnetic environment assessment E4

Berlin, 2012-02-02

Thomas Funk, president