EV DYNACORD ®
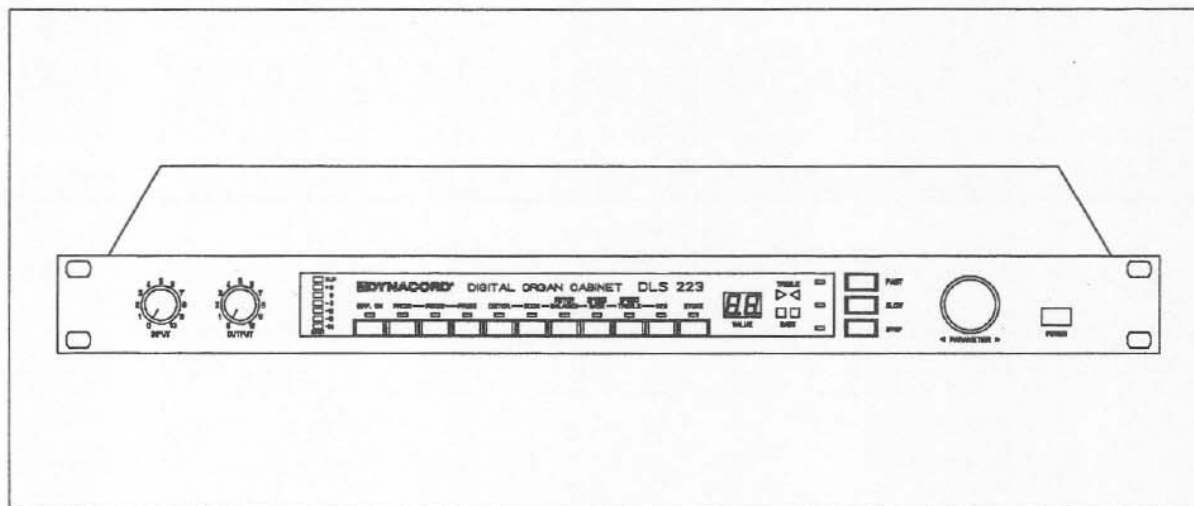
DLS 223

Digital Organ Cabinet

1. INTRODUCTION

We should like to start by thanking and congratulating you for purchasing the Digital Organ Cabinet Simulator DLS 223 from DYNACORD.

The DLS enables supreme quality, natural-sounding digital reproduction of the typical effects of loudspeaker rotor systems. The various programs make for prime simulation of the original cabinets on which it was based. All the originals' typical properties such as different frequency responses, rotor speeds, coloration, start-up and decay times have all been determined via precise measuring techniques and subjected to psycho-acoustic analysis. In the DLS 223 the 24 bit signal processor ARS-10 calculates the identical algorithms, thus providing perfect simulation of the original sound in stereo.

A room simulation can be allocated to any of the programs which calculates the reflections of the rotating loudspeaker depending on the room type and size and adds the effect. This procedure is significantly more accurate and sounds a lot more natural than reverberating the effect via a random echo program.

Preferential room simulations have been allocated to each program. These can, however, be changed. All function keys have status LED's which signalize the current operating mode quickly and clearly. A special display indicates the rotor speeds. The parameters are edited via a rotary encoder, the respective values of the selected parameters being indicated with a 2-digit display. Alterations of the parameters can be stored under one of three program memory places.

It goes without saying that remote control of the DLS 223 is also possible via MIDI. The unit is thus equipped with IN-OUT-THRU sockets for integration into a MIDI system. The power supply of the DLS 223 adapts automatically to mains voltages of 90 - 250 V (50-60 Hz).

This user's manual provides a wealth of information about the DLS 223. Please read it through carefully and we guarantee you immense pleasure with your new Digital Organ Cabinet Simulator DLS 223 from DYNACORD.

IMPORTANT NOTES

ATTENTION: This unit must be protected from damp because of fire risk and the possibility of electric shocks.

1. Make sure that nothing, especially no metal objects, are inserted into the device. This could result in a severe electric shock or malfunction.

2. If the unit is subjected to extreme fluctuations of temperature, e.g. on being transported from outside to a heated room, condensation can form. The unit should not be used until it has reached room temperature.

3. If water or any other liquid is spilt on to the unit accidentally, the unit should be switched off immediately and taken to a servicing facility to be checked.

4. Make sure that the unit is always well ventilated and never exposed to direct sunlight.

5. Do not use sprays to clean the unit as they have a detrimental effect on the unit and could ignite suddenly.

2. CONNECTIONS AND CONTROLS
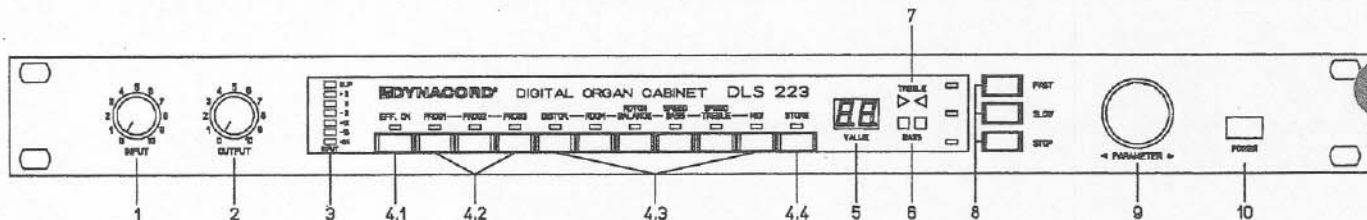
2.1 FRONT PANEL

1 INPUT CONTROL

This input control serves to alter the level of the input signal to achieve optimum modulation of the DLS 223 (0 dB on the level indicator). (Also see 17 HI/LO).

2 OUTPUT CONTROL

The output control serves to change the output level of the DLS 223 to drive subsequent appliances with the optimum level.

3 LEVEL INDICATOR

This serves for level control of the input signal. The optimum setting is 0 dB.

A further feature is the Peak/Hold function which facilitates levelling.

4.1 EFFECT ON

switches between the original signal (LED off: Input Output) and Effect signal (LED On: Input > Effect > Output).

4.2 PROG 1, PROG 2, PROG 3

trip each other and select one of the three cabinet simulations. Each program uses different parameter values (ROTOR- SPEED, BALANCE, various rooms, distortion,) and different sound settings (Equalizer).

These programs can be stored with altered parameters.

4.3 PARAMETERS and MIDI

The keys Distortion, Room, Rotor-Balance, Rotor-Speed Bass, Rotor-Speed Treble and Midi trip each other (respective Status LED lights up) and select the access of the rotary encoder (9) with Display (5) to the respective function.

4.4 STORE

This key serves to store the current setting on one of the three program memory places.

Pressing the key a little longer time deletes the user programs and loads the factory presets (factory programs) on to all three program memory places.

5 UNIVERSAL DISPLAY

This two-digit display has different meanings, depending on the function selected (Status LED). If MIDI has been selected, this is shown on the display, parameter value display, MIDI received, option numbers and values.

The display goes off after 10 seconds.

The display is turned on either by pressing or turning the rotary encoder (9) or by pressing one of the keys (4.3).

6 ROTOR DISPLAY

This display allows a visual check of the bass rotor of an organ cabinet.

7 ROTOR DISPLAY

This display allows a visual check of the treble rotor of an organ cabinet.

8 STOP, SLOW, FAST

This switches the rotor speed for treble and bass cabinets into one of the three steps.

9 ROTARY ENCODER WITH KEY

The meaning of this key depends on the function selected (Status LED). If MIDI has been selected, the MIDI channel is altered, parameter value control, option numbers and value control.

Pressing and turning this encoder at the same time accelerates settings.

Pressing the encoder briefly makes the display (5) brighter.

10 POWER SWITCH

This serves to switch the DLS 223 on or off.
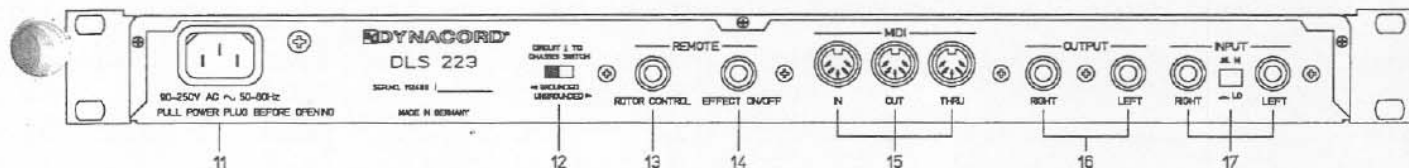
2.2 REAR PANEL

11 Mains socket

The enclosed Euro mains cable is connected here to put the DLS 223 into operation. The DLS 223 is equipped to deal with mains voltages between 90 V and 250 V and is thus not affected in any way by disturbances caused by fluctuating mains voltages.

12 Groundlift switch

This serves to prevent hum loops. If the DLS 223 is operated in a 19" rack together with other appliances, the switch should be set at GROUNDED. If the DLS is operated together with other equipment with differing earthing potential, the switch should be set at UNGRO-UNDED.

13 Remote Socket ROTOR CONTROL

A foot switch FS 223 from DYNACORD (optional accessory) can be conected here to switch over the rotor speeds in three steps (from Stop, Slow and Fast).

14 Remote Socket EFFECT ON/OFF

A DYNACORD foot switch FS 12 (optional accessory) can be connected to this socket to switch over between the original signal (Input > Output) and effect signal (Input > Effect > Output).

15 MIDI sockets (IN/OUT/THRU)

The output of a MIDI unit (keyboard, computer) can be connected to the MIDI IN socket, thus enabling remote control of all functions (keys, parameters...). Up to 38 parameters can be changed via MIDI IN (Sysex).

The input of a MIDI unit can be connected to the MIDI OUT socket. All settings and activities (keys, parameters ...) are issued at this socket and can be evaluated to control the DLS 223. (Sysex).

All data received via MIDI are transmitted in an unchanged format at the MIDI THRU socket.

Please turn to chapter 7 for further details.

16 Sockets OUTPUT LEFT/RIGHT

These are the DLS 223's stereo outputs. The output level can be altered via the output control (2). If only one of the sockets is used, a MONO sum is obtained from the left and the right output.
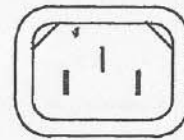
The optimum room sound simulation of an organ cabinet can only be achieved if both outputs (stereo) are used.

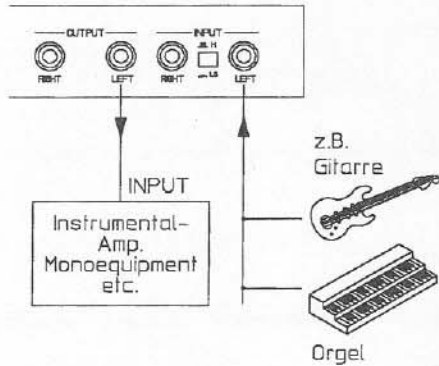### 17 Sockets INPUT/LEFT/RIGHT and selector switch HI/LO.

These are the DLS 223's stereo inputs. The selector switch is used to switch between the LO input (+0dBm) and the HI input (- 20dBm). To feed in a MONO signal it is sufficient to connect only one of the two input sockets.
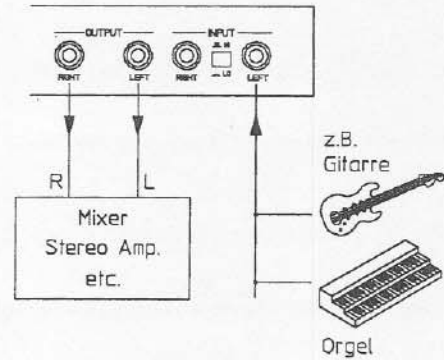
3. SETTING-UP THE DLS 223

To achieve the best possible results, your DLS 223 must be connected correctly. For start-up purposes use the enclosed Euro mains cable to connect the mains socket and the DLS 223.
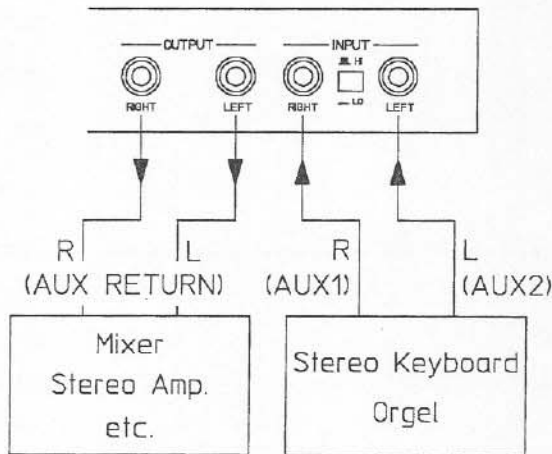
3.1 Mono in/Mono out

INPUT

Instrumental-
Amp.
Monoequipment
etc.

z.B.
Gitarre

Orgel

3.2 Mono in/Stereo out

R   L

Mixer
Stereo Amp.
etc.

z.B.
Gitarre

Orgel

3.3 Stereo in/Stereo out

R   L   R   L
(AUX RETURN)   (AUX1)   (AUX2)

Mixer
Stereo Amp.
etc.

Stereo Keyboard
Orgel

IMPORTANT!

- Some keyboards feature "stereo outputs" which are not mono- compatible. The two outputs sometimes only differ by a phase shifting on the second channel. This phenomenon is sometimes also referred to as "quasi-stereophone".

- As the rotor effects of both inputs are taken into consideration (summed), this can lead to fluctuating amplitudes or cancellations of the signal.

- This situation can be remedied by connecting one keyboard output with one of the DLS 223 inputs.

- Always use well-screened audio cables.

- To avoid loss of trebles, the cables should not be longer than 10 metres. This especially applies to those leading to the inputs.

- Never position the unit directly under or on a powerful amplifier, TV monitor or the like, as the leakage field of the transformers pertaining to such appliances can cause hums influence into the electronics of the DLS 223.

3.4 Position of the Groundlift switch

The groundlift switch serves to avoid hum loops. It must be positioned appropriately, depending on the operating mode in question.

UNGROUNDED: If the DLS 223 is operated with other appliances which have a different earthing potential.

GROUNDED: If the DLS is operated together with other units in a 19" rack.

CIRCUIT ⊥ TO
CHASSIS SWITCH

◄ GROUNDED
UNGROUNDED ►

4. START UP

4.1 SWITCHING THE UNIT ON

1. Switch the DLS 223 on via the POWER switch (10).

POWER

2. The unit is now in switched on status. The last program (1-3) stored via STORE appears, the last MIDI channel or MIDI OFF stored via STORE is selected, parameter ROTOR BALANCE is selected, Display (5) briefly indicates the software version number (e.g. 1.0) and is then dark, Effect is switched ON and the rotors are at a standstill (STOP).

EFF. ON	PROG1	PROG2	PROG3	DISTOR.	ROOM	ROTOR BALANCE	SPEED BASS	SPEED TREBLE	MIDI	STORE

VALUE
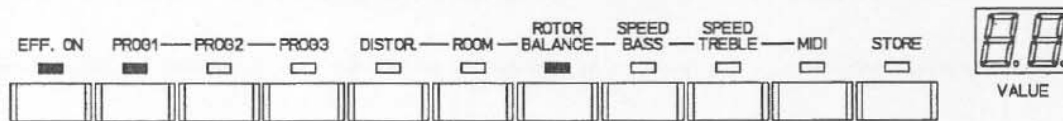
3. The DLS 223 is subsequently ready for operation.

4.2 SETTING LEVELS

1. First adjust the setting of the INPUT selector switch according to the equipment connected.

2. Whilst you are setting the level with the INPUT control (1), constantly check the maximum indication on the LEVEL DISPLAY (3). The optimum value is 0 dB. If the level range should be inadequate, press the INPUT selector switch (at the rear) to HI/LO position. The CLIP LED indicates internal overloading and should not be lit up on any account.

INPUT
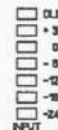
LO: This range is selected for low levels such as guitar or bass guitar.

**HI:** This range is selected for medium to high levels such as AUX OUTPUT, audio equipment with line level.

—— INPUT ——

RIGHT   ■ HI   LEFT
           — LO
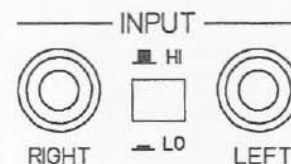
5. OPERATION

5.1 EFFECT ON/OFF FUNCTION:

This key switches between the original signal and the effect signal. The level setting (Input/Output control) works for both functions.

A foot switch and MIDI can also be used for switching over between the two signals.
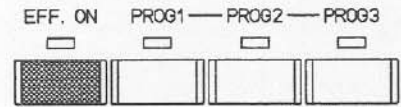
5.2 PROGRAM SELECTION

Pressing one of the three program keys briefly loads the respective cabinet simulation. The according LED lights up.

Pressing one of the three program keys long (3 sec.) loads the factory preset to that particular program place and calls it up. The LED fades briefly to serve as a visual signal!! A program stored on that program place is thus deleted.

Further factory presets can also be loaded (see MIDI and OPTION).
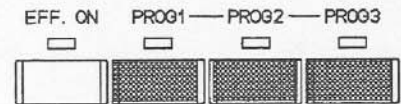
> **Note:**
>
> The factory presets vary in as many as 40 parameters.

5.3 EDITING PARAMETERS:

If one of the parameter keys is pressed, its value is indicated on the two-digit display. The corresponding Status LED lights up. The rotary encoder (9) can be used to alter the setting and takes immediate acoustic effect. The number range depends on the parameter selected.

> **Note:**
>
> The rotary encoder is a fine detent knob with an integrated key. It can be turned infinitely to left or right. It works as an electronic counter which counts one step further every time it is turned one increment. Keeping the key pressed down whilst turning means that 10 steps are counted per increment.

5.4 STORING PROGRAMS

Pressing the STORE key causes the Store Status LED to flash on and off. Pressing one of the 3 program keys stores the current setting in question under this program number. The LED's on the front panel fade briefly to serve as a visual signal of this phenomenon.

A program can only be stored within 5 seconds of the STORE key (LED's flash on and off) so as to prevent unintentional programming.
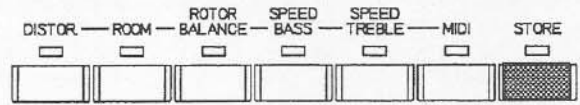
Pressing the STORE key longer (3 seconds) restores the factory presets in all three program places. The LED's on the front panel fade briefly to provide a visual signal.

This deletes a program stored under one of these program places.

> **Note:**
>
> **Any changes to parameters (front panel, MIDI, OPTION) are also stored.**

Further factory presets can be accessed via MIDI and OPTION.

5.5 DESCRIPTION OF THE PARAMETERS

When one of the parameter keys is pressed, its Status LED lights up briefly and the parameter can now be changed via the rotary encoder (9). The respective value can be checked by consulting the display (5). Parameters can also be set via MIDI.

DISTOR:

The DLS 223 has an integrated distorter which creates tube-like distortion sounds.

The value 0 switches the distorter off, higher values increase the distortion factor.

ROOM:

This parameter is used to set a room simulation. The value 0 switches the room effect off. Higher values correspond to larger rooms.

The simulation is not effected by reverbing the signal but the room acoustics are reproduced depending on the position of the cabinet rotors. The cabinet stands with the back wall near to a room limitation (wall). The listener is at the front of the cabinet. This permits a natural sounding simulation of the acoustics of rotor cabinets in various rooms.
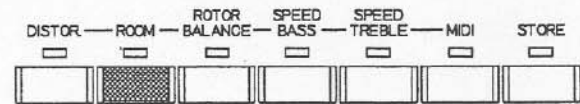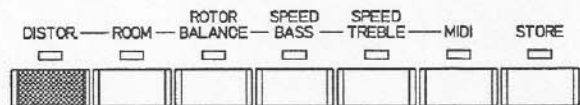
> **Note:**
>
> Many parameters which also contribute to the characteristics of rooms can be changed via MIDI (Sysex) or OPTION. Examples include the frequency response or the distance between the listener and the cabinet.

ROTOR BALANCE

This control determines the acoustic balance between the treble and bass sections. The value 0 supplies the same output level for both rotors. Negative values (-) emphasize the bass rotor; positive values (+) emphasize the treble rotor. This parameter is sometimes called Volume Bass or Volume Treble on some cabinets.

> **Note:**
>
> The X-over frequency of both rotors can be altered via MIDI (Sysex) or OPTION.
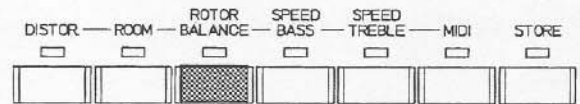
SPEED-BASS

This serves to alter the rotation speed of the bass rotor. This setting affects the FAST and SLOW speeds, thus maintaining a constant ratio between the two.

> **Note:**
>
> The ratio between FAST and SLOW can also be altered via MIDI (Sysex) and OPTION.
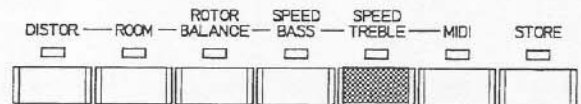
SPEED-TREBLE

This serves to alter the rotation speed of the treble rotor. This setting affects the FAST and SLOW speeds, thus maintaining a constant ratio between the two.

> **Note:**
>
> The ratio between FAST and SLOW can also be altered via MIDI (Sysex) and OPTION.

6. OPTION

In the OPTION MODE it is possible to alter many additional parameters and settings. These corrections can be stored into one of the three programms.

Examples include: sound impression via multi-band equalizer, additional factory presets, ratio between the rotation speeds FAST and SLOW, rotation reversal, modulation depth for amplitude and frequency, room size...

These possibilities are described in this chapter. MIDI users (Sysex) can control them from their computers (see MIDI Chapter 7). A table illustrating this topic is included at the end of the chapter.

6.1 ACTIVATING THE OPTION MODE

This is called up by pressing both the SPEED BASS and the SPPED TREBLE keys for three seconds. The Status LED of the SPEED BASS key begins to flash on and off and a figure (control number) appears on the display (5).

6.2 OPERATION OF OPTION MODE

Pressing the key SPEED BASS (Status LED flashes on and off) means that a parameter or a function can be selected via the rotary encoder (9). The corresponding number is shown on the display (5).
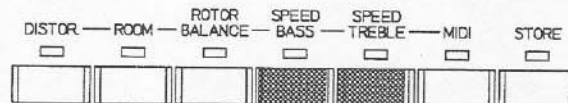
Pressing the key SPEED TREBLE (Status LED flashes on and off) means that the value (control setting) of the parameter selected is shown on the display (5). This setting can be altered via the rotary encoder (9). The control range depends on the parameter selected.

## 6.3 CONCLUDING OPTION MODE AND STORING

Pressing either keys "DISTORTION", "ROOM", "ROTOR BALANCE" or "MIDI" switches the OPTION MODE off.

The edited settings are stored by pressing the STORE key. The STORE status LED and the three program LED's begin to flash on and off and pressing one of the program keys stores the current setting in question. This is how the OPTION mode is concluded. The program key must be selected within 5 seconds as the storage mode is interrupted otherwise. (flashing ceases).
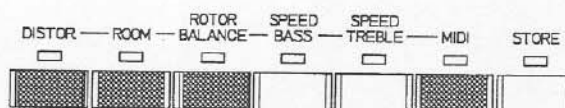
## 6.4 FUNCTION 00 = ADDITIONAL FACTORY PRESETS

Press the key "SPEED BASS", set 00 with the rotary encoder, press the key "SPEED TREBLE" and select a preset via the rotary encoder (see current preset list). The preset which is selected can be listened to immediately, can be altered (see OPERATION OF OPTION MODE) and stored on one of the three program places, (see CONCLUDING OPTION MODE AND STORING).
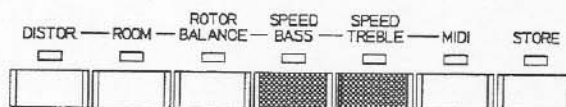
6.5 OPTION-Parameter 01 - 46

NOTE:

The sequence of programmable parameters is as follows:

Sequence of the programmable Parameters
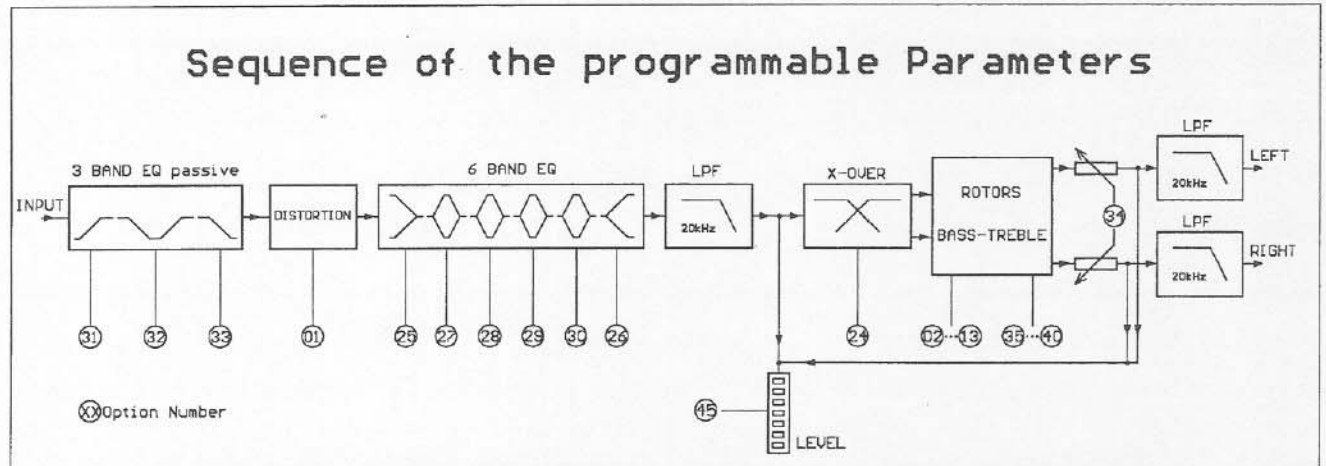
This is so as to recognize the effects of editing these parameters (e.g. level display, non-linear functions...)

PARAMETER 01 = DISTORTION

This tube-like distorter precedes the rotors and can reach values ranging between 0 and 15. (15 = high distortion factor). See also DESCRITPION PARAMETER page 5-2.

PARAM. 02 = ROOM

Possible values range between 0 (no reverb) and 15 (large room). See DESCRIPTION PARAMETER, page 5-2.

PARAM. 03 = ROTOR BALANCE

Possible values range between -9 (high bass content) to +9 (high treble content). See DESCRIPTION PARAMETER page 5-3.

PARAM. 04 = SPEED BASS
PARAM. 05 = SPEED TREBLE

Possible values range between 0 (rotor at standstill) to 99 (high rotation speed).

See DESCRIPTION PARAMETER, page 5-3.

PARAM. 06 = SLOW-FAST RATIO BASS ROTOR
PARAM. 07 = SLOW-FAST RATIO TREBLE ROTOR

This parameter determines the speed ratio between Slow and Fast (Keys 8). The FAST speed remains constant, whilst the value of this parameter can be altered from 0 (SLOW Speed at standstill) to 99 (SLOW SPEED almost FAST).

PARAM. 08 = SPEED-UP BASS-ROTOR
PARAM. 09 = SPEED-UP TREBLE ROTOR

This parameter determines the acceleration of the rotation speed when switching from STOP to SLOW or FAST.

The value is specified in terms of a time and can be changed from 0 (quick start-up) to 99 (slow start-up).

PARAM. 10 = SPEED-REDUCE BASS-ROTOR
PARAM. 11 = SPEED-REDUCE TREBLE ROTOR

This parameter determines the braking properties of the rotor when switching from FAST to SLOW or STOP.

The value is specified in terms of a time and can be changed from 0 (quick braking) to 99 (slow braking).

PARAM. 12 = ROTATE DIRECTION BASS-ROTOR
PARAM.13 = ROTATE-DIRECTION TREBLE-ROTOR

This parameter switches the direction from clockwise (right = c) to anti-clockwise (left = ac).

PARAM. 14 = FREQUENCY-VIBRATO BASS
PARAM. 15 = FREQUENCY-VIBRATO TREBLE

This parameter determines the intensity of the alteration in sound pitch which is audible due to a rotating sound source on the listener's side of the cabinet. Closer proximity of the listener increases the intensity of the vibrato. Possible values range between 0 and 15 (see also Options 16, 17),

PARAM. 16 = VIBRATO-EDGE-BASS
PARAM. 17 = VIBRATO-EDGE-TREBLE

This control is used to change the curve form of the pitch jump (also see options 14,15). The modulator curve can be set steplessly between 0 (triangular form) and 15 (trapezoid form).

PARAM. 18 = PANORAMA-BASS
PARAM. 19 = PANORAMA-TREBLE

This parameter determines the intensity of the left/right modulation, thus changing the stereophone sound image acoustically. Possible settings range between 0 and 7 (= extreme stereo).

PARAM. 20 = FRONT-BACK-BASS
PARAM. 21 = FRONT-BACK-TREBLE

This parameter determines the volume modulation between front and back. With the value 0 this crossfading is missing and the panorama modulator (18, 19) dominates. The value 7 is the maximum deviation for the front-back simulation.

PARAM. 22 = ROOM-BACK-BASS
PARAM. 23 = ROOM-BACK-TREBLE

This parameter determines the volume of the simulated room when the rotors are pointing towards the back. (The room is selected via Opt. 02). The value 0 corresponds with low-reflecting walls, 7 simulates walls without absorption.

PARAM. FOR ALTERATIONS TO SOUND FREQUENCY RESPONSE

The loudspeakers and high frequency horn drivers used in those days, coupled with the properties and designs of the housings (slits, fabric ...) and high frequency horns gave the organ sound different sound colourations. A variety of cabinets were used to ascertain dominant frequency bands which were then realized as programmable EQ.

PARAM. 24 = CROSSOVER FREQUENCY

This parameter determines the sound crossover frequency between bass and treble rotor. The value can be altered from between 0 (see diagram) and 15 (fx = 7 kHz).
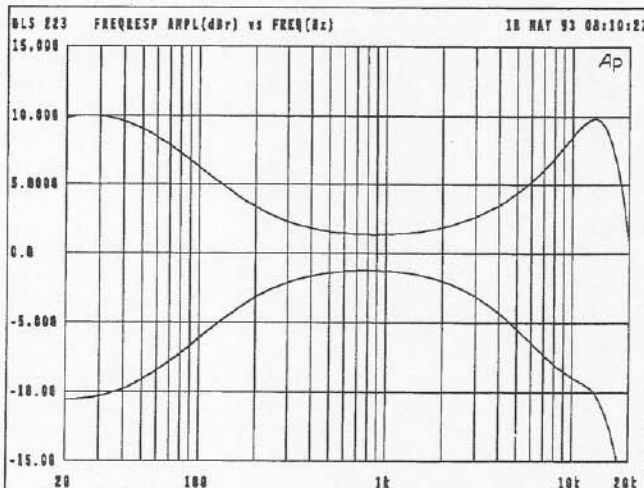
Control No. 24 = 0
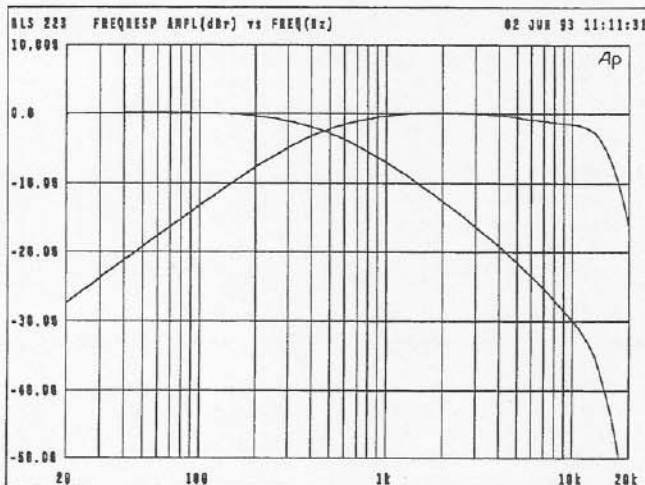
Graph 1 = Bass Rotor
Graph 2 = Treble Rotor

PARAM. 25 = ACTIVE BASS
PARAM. 26 = ACTIVE TREBLE

The value can amount to -5..0..+5 (see diagram).
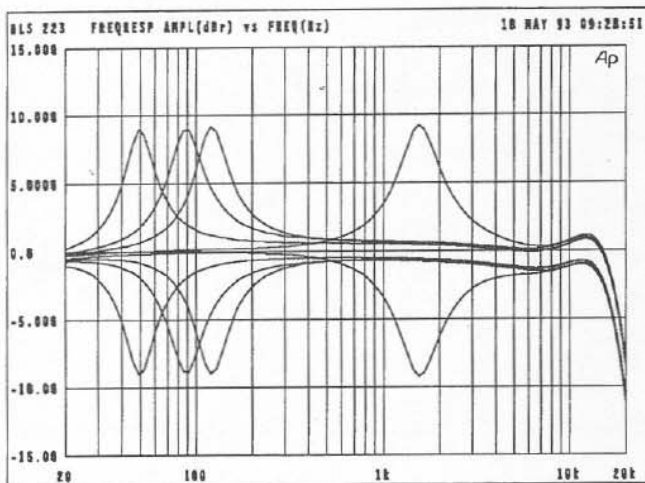

All controls 25-33 to 0 apart from:
Graph 1 Bass (No. 25) and Treble (No. 26) = +5
Graph 2 Bass (No. 25) and Treble (No. 26) = -5

PARAM. 27 = EQUALIZER BAND 48 Hz
PARAM. 28 = EQUALIZER BAND 85 Hz
PARAM. 29 = EQUALIZER BAND 125 Hz
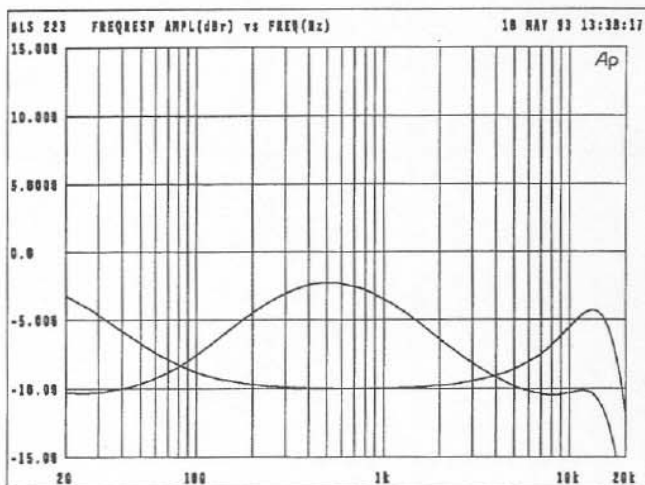*PARAM. 30 = EQUALIZER BAND 1500 Hz*

The value can amount to -5..0..+5 (see diagram).

All controls 25-33 to 0 apart from:
controls 27, 28, 29 and 30 each to +5 (boost)
and -5 (cut).

PARAM. 31 = PASSIVE BASS
PARAM. 32 = PASSIVE MID
PARAM 33 = PASSIVE TREBLE

The value can amount to -5..0 (see diagram).

All controls 25-33 to 0 apart from:
Graph 1 Bass (No. 31) and Treble (No. 33) = -5
Graph 2 Mid (No. 32) = -5

PARAM. 34 = OUTPUT LEVEL

Volume variations between the individual programs can
be balanced. The total output level for the left and right
channel is changed between -- (= Off) to -7 and +7).

PARAM. 35 = COMB-DELAY-BASS
PARAM. 36 = COMB-DELAY-TREBLE

This parameter determines the lower cutoff frequency of
the comb filter which is created by mixing the phase-shif-
ted tones (phaser). Possible settings range between 0
(min. delay) and 31 (max. delay).

PARAM 37 = COMB-DEPTH BASS
PARAM 38 = COMB-DEPTH TREBLE

This parameter determines the depth (quality) of the
comb filter (also see opt. 35, 36). The value can be
altered from -7 (no comb filter) to 0 (strong comb filter).

PARAM. 39 = COMB-DIRECTION-TREBLE

This parameter fixes the comb filter of the treble rotor as
a notch filter (0 = cancellations) or as boost (= 1):

PARAM. 40 = STOP-DIRECTION

This parameter determines the direction of the rotors in
the "STOP" position. The random stop position is main-
tained with the value 0 (as with most cabinets). The value
1 corrects the stop position to the front side (like CLS
222). Random stop positions can lead to a sound diffe-
ring after every stop, e.g. too strong reverberation (indi-
rect sound) if the rotors come to a halt at the rear side of
the cabinet and ROOM is switched on.

PARAM. 41 = POSITION-CONTROL-BASS
PARAM. 42 = POSITION-CONTROL-TREBLE

These two parameters allow a visual check of the posi-
tion of the rotors in the display (5). The bass rotor is
indicated in the tens digit, the treble rotor in the units digit.
If the rotors are switched to "STOP", the position can be
altered manually via the rotary encoder (9). If "STOP
DIRECTION" is switched to 0 (parameter 40), the edited
position is maintained.

PARAMETER 43 = SPEEDO-CONTROL-BASS
PARAMETER 44 = SPEEDO-CONTROL-TREBLE

These two parameters allow a visual check of the speed
of the rotors in the display (5). Values displayed can
range between 0 (standstill) to 99.

PARAM. 45 = LEVEL-PEAKHOLD-TIME

This parameter sets the hold time of the Peak LED in the
input level meter (3). Settings are possible between 0
and 42 (1 step = 0.1 sec.). "STORE" saves this hold time
(global parameter).

PARAM. 46 = RECEIVE - REMOTE - SYSEX

This switch activates the remote control feature via MIDI
SYSEX data (=1). The value 0 blocks the reception of
remote control data.

LIST OF OPTIONS

FUNCTION   00 = ADDITIONAL FACTORY PRESETS
PARAMETER 01 = DISTORTION
PARAMETER 02 = ROOM
PARAMETER 03 = ROTOR-BALANCE
PARAMETER 04 = SPEED-BASS
PARAMETER 05 = SPEED-TREBLE
PARAMETER 06 = SLOW-FAST RATIO BASSROTOR
PARAMETER 07 = SLOW-FAST RATIO TREBLEROTOR
PARAMETER 08 = SPEED-UP BASS-ROTOR
PARAMETER 09 = SPEED-UP TREBLE-ROTOR
PARAMETER 10 = SPEED-REDUCE BASS-ROTOR
PARAMETER 11 = SPEED-REDUCE TREBLE-ROTOR
PARAMETER 12 = ROTATE-DIRECTION BASS-ROTOR
PARAMETER 13 = ROTATE-DIRECTION TREBLE-ROTOR
PARAMETER 14 = FREQUENCY-VIBRATO-BASS
PARAMETER 15 = FREQUENCY-VIBRATO-TREBLE
PARAMETER 16 = VIBRATO-EDGE-BASS
PARAMETER 17 = VIBRATO-EDGE-TREBLE
PARAMETER 18 = PANORAMA-BASS
PARAMETER 19 = PANORAMA-TREBLE
PARAMETER 20 = FRONT-BACK-BASS
PARAMETER 21 = FRONT-BACK-TREBLE
PARAMETER 22 = ROOM-BACK-BASS
PARAMETER 23 = ROOM-BACK-TREBLE
PARAMETER 24 = CROSSOVER FREQUENCY
PARAMETER 25 = ACTIVE BASS
PARAMETER 26 = ACTIVE TREBLE
PARAMETER 27 = EQUALIZER BAND 48Hz
PARAMETER 28 = EQUALIZER BAND 85Hz
PARAMETER 29 = EQUALIZER BAND 125Hz
PARAMETER 30 = EQUALIZER BAND 1500Hz
PARAMETER 31 = PASSIVE BASS
PARAMETER 32 = PASSIVE MID
PARAMETER 33 = PASSIVE TREBLE
PARAMETER 34 = OUTPUT-LEVEL
PARAMETER 35 = COMB-DELAY-BASS
PARAMETER 36 = COMB-DELAY-TREBLE
PARAMETER 37 = COMB-DEPTH-BASS
PARAMETER 38 = COMB-DEPTH-TREBLE
PARAMETER 39 = COMB-DIRECTION-TREBLE
PARAMETER 40 = STOP-DIRECTION
PARAMETER 41 = POSITION-CONTROL-BASS
PARAMETER 42 = POSITION-CONTROL-TREBLE
PARAMETER 43 = SPEEDO-CONTROL-BASS
PARAMETER 44 = SPEEDO-CONTROL-TREBLE
PARAMETER 45 = LEVEL-PEAKHOLD-TIME
PARAMETER 46 = RECEIVE - REMOTE - SYSEX

LIST OF FACTORY PRESETS (FUNCTION 00)

PRESET 01 = "Electronic Rotor"
PRESET 02 = "Echolette Rotor"
PRESET 03 = "Original Rotor"
PRESET 04 = "Soft Organ"
PRESET 05 = "Jazz Organ"
PRESET 06 = "Rock Organ 1"
PRESET 07 = "Rock Organ 2"
PRESET 08 = "Clean Fast"
PRESET 09 = "Different Speeds"
PRESET 10 = "Top Slow Speed"

PRESET 11 = "Stacked Rotor 1"
PRESET 12 = "Stacked Rotor 2"
PRESET 13 = "Club Cabinet 1"
PRESET 14 = "Club Cabinet 2"
PRESET 15 = "Open Air"

7. MIDI

MIDI connection is possible via the MIDI sockets IN/OUT/THRU (15). The MIDI functions within the DLS 223 allow the appliance to be controlled externally. The diverse and flexible possibilities mean that all functions can be controlled from a MIDI-compatible unit (e.g. computer, sequencer, keyboard...). E.g.

- Switching over programms

- Changing certain parameters

- Switching the effect signal on or off

- Switching over the rotor speed

- All control elements (remote control of the DLS 223)

and many, many more.....

Should you still not have had any experience with MIDI we recommend that you first gather information on MIDI standards and interfaces (e.g. MIDI books, computer and music journals etc.) There is also a brief explanation in the annex, chapter 9).
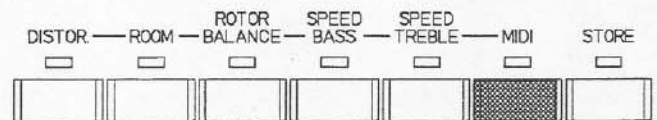
7.1 BASIC SETTINGS

Pressing the MIDI key briefly puts the MIDI channel or mode on the display (5). Alterations can be made via the rotary control (9) and take effect immediately.

The following settings are possible:

"--" no MIDI evaluation (MIDI OFF)

"on" MIDI reception in Omni Mode (all channels are received)

"01" - "16" reception on MIDI channel 1 - 16

7.2 MIDI INPUT CONTROL

If there are data on the MIDI INPUT (15) which comply with MIDI channel or mode selected in the DLS 223, the decimal point of the display (5) lights up briefly.
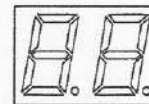
VALUE

7.3 REMOTE CONTROL VIA MIDI

All DLS 223 parameters and keys can be remote controlled in real time via the MIDI INPUT (15). This necessitates a MIDI-compatible device as a MIDI transmitter.

To control the DLS 223 via a MIDI Controller, this allocation takes place in LEARN MODE.

All MIDI CONTROLLERS or MIDI functions (note on/off...) can be used to control the DLS 223.

7.4 MIDI LEARN MODE

You can switch to the LEARN MODE of the DLS 223 by pressing the required function key together with the MIDI key.

Readiness to learn is indicated via common flashing of the MIDI LED and the LED of the key to be "learnt".

Possible key functions include EFF.ON, PROG1, PROG2, PROG3, STOP, SLOW or FAST.

Possible control functions include DISTOR., ROOM, ROTOR-BALANCE, SPEED-BASS, SPEED-TREBLE.

If a MIDI event is received and accepted on the MIDI input, (the decimal point lights up as described under 7.2), flashing ceases and the key which has been learnt is then carried out for the first time.

The function which has been learnt applies to all 3 programms (global allocation) and is saved, i.e. is maintained even after the DLS 223 has been switched off and is available again once the DLS has been switched on.

Several ("all") switches and parameters of the DLS 223 can be learnt in this way. Allocations of various control functions to the same MIDI controller are also possible.

The learn mode can be cancelled by pressing any key.
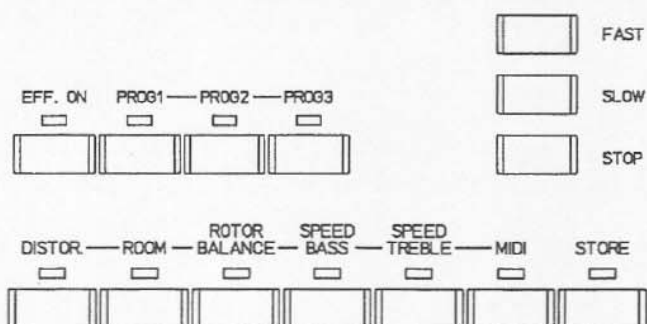
7.5 DELETING MIDI ALLOCATIONS

Pressing the MIDI key for 3 seconds deletes "all" MIDI allocations learnt. Delation is indicated by the Status LED's fading briefly.

A single MIDI Event which has been learnt can be deleted by pressing the MIDI and the respective function key together for 3 seconds. The MIDI LED and the status LED to be deleted flash on and off together for the duration of the 3 seconds. The event is subsequently deleted, this being indicated when the flashing ceases.
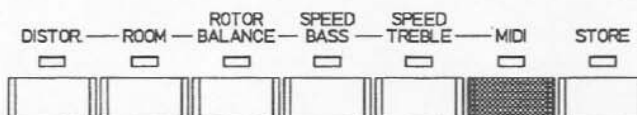
7.6 MIDI-LEARN EXAMPLE

A description of how to control the rotor speed serves as an example to show the possibilities to control the DLS via MIDI.

There are 3 different solutions depending on the type of MIDI transmitter (keyboard) in question.

1   Your MIDI keyboard has three free switches (MIDI switch) which can be used to control the DLS 223 functions "STOP", "SLOW" and "FAST". The three keys are learnt successively in MIDI LEARN MODE.

2   Your MIDI keyboard has a free controller (e.g Modulation Wheel) which should be used to control the DLS functions "STOP", "SLOW" and "FAST". The controller on the keyboard is turned down as far as possible and then the DLS 223 is switched to the MIDI LEARN MODE for "STOP". Moving the controller briefly is enough to learn the "STOP" key. The controller is moved into a central position, the DLS 223 is put into MIDI LEARN MODE for the "SLOW" key and the controller is moved briefly. The modulation wheel is moved up as far as possible, the DLS 223 is put into MIDI LEARN MODE for "FAST" and the wheel is moved briefly. The controller modulation wheel can now be used to switch over the DLS 223 functions "STOP", "SLOW" and "FAST". The controller range can be divided up as follows: lower third "STOP", middle third "SLOW", upper third "FAST".
The ranges (MIDI RANGE) can be selected as required and are learnt in LEARN MODE by the current position of the controller.

3   Your MIDI keyboard has a free controller (e.g. modulation wheel) which should be used to control the DLS 223 function "SPEED BASS", "SPEED TREBLE". The DLS 223 is switched to MIDI LEARN MODE for "SPEED BASS". (MIDI and SPEED BASS LED's flash on and off). The controller is moved briefly (flashing goes off) and has thus been learnt. The same procedure is followed for "SPEED TREBLE". The "FAST" key on the DLS 223 is pressed, thus enabling the user to adjust the speed of the two rotors with the modulation wheel. The range (MIDI RANGE) is steplessly adjustable between standstill and maximum speed.

Note:

All these functions are stored automatically as global MIDI allocations (without STORE key). That means that they are applicable for all three programms and are also maintained after the DLS 223 has been switched off.

MIDI ARRANGEMENTS

The DLS 223 reacts to so-called MIDI Events.

Reception of a MIDI Event corresponds to a key being pressed on the DLS 223 (see key functions (7.4), provided that this has been learnt before. All functions possible via MIDI and CONTROLLER serve as MIDI Events.

Once a DLS 223 parameter has been learnt (see control functions (7.4)), this entire control range (100%) is allocated to the entire valuation range (100%) of the MIDI CONTROLLER.

7.7 MIDI System Exclusive Implementation

This chapter contains information to enable programmers to write software for the DLS 223. It contains definitions of all commands necessary to transmit or receive data via the MIDI interface.
Data transfer is only possible by MIDI when a MIDI channel has been set (OMNI, 1 - 16). With a MIDI reception channel - - there is no communication via the MIDI interface (see Chapter 7.1).

MIDI system exclusive DYNACORD DLS 223
MIDI SYSEX DLS 223 Version 1.0.

SYSEX-FUNCTION "IDENTITY REQUEST":	(recognized)
F0h	message "system-exclusive"
7Eh	sysex-id "universal non-realtime"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
06h	id "general information"
01h	function-code "identity request"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to report with its identity code.

SYSEX-FUNCTION "IDENTITY REPLY":	(transmitted)
F0h	message "system-exclusive"
7Eh	sysex-id "universal non-realtime"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
06h	id "general information"
02h	function-code "identity reply"
30h	manufacturer-id "DYNACORD" no.48
17h 00h	device-family-code "DLS223" no.23
00h 00h	device-family-member
yyh yyh yyh yyh	revision-code in ascii (i.e. "1.0 ")
F7h	message "end of system-exclusive"

The DLS 223 transmits this identity code in answer to an identity request.

SYSEX-FUNCTION "REQUEST CURRENT PARAMETERS":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
10h	function-code "request current parameters"
yyh	number of first parameter requested
zzh	number of last parameter requested
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transfer one or more parameters to the program setting which can currently be heard. In answer the DLS 223 transmits a SYSEX record in format "Parameter Adjust". See also the following list of "Parameter Adjust Numbers".

SYSEX-FUNCTION "PARAMETER ADJUST":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
30h	function-code "parameter adjust"
yyh	number of first parameter to adjust
vvh	value of first parameter to adjust
[vvh .. vvh]	value(s) of next following parameter(s) to adjust
F7h	message "end of system-exclusive"

This command is used to edit one or more parameters in the current setting. Each parameter is represented by one MIDI data byte. These edits are active immediately. User programs are not altered!

See the following list of "Parameter Adjust numbers".
[...] optional

SYSEX-FUNCTION "REQUEST CURRENT PROGRAM DUMP":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
11h	function-code "request dump current program"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transmit the current program setting as a complete data record. In answer the DLS 223 transmits a Sysex record in the format "Current Program Dump".

See also the following list "Program Structure".

SYSEX-FUNCTION "CURRENT PROGRAM DUMP":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
31h	function-code "dump current program"
yyh .. yyh	30 bytes midi8/7-code (program-structure)
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted completely as the current program. User programs are not altered!

See also the following list "Program Structure".

SYSEX-FUNCTION "REQUEST SINGLE PROGRAM DUMP":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
14h	function-code "request dump single program"
yyh	source-number of requested program (1..3)
zzh	destination-number of requested program (1..3)
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transfer a single user program setting as a complete data record. In answer the DLS 223 transmits a Sysex record in the format "Single Program Dump".

See also the following list "Program Structure".

SYSEX-FUNCTION "SINGLE PROGRAM DUMP":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
34h	function-code "dump single program"
zzh	destination-number of program (1..3)
yyh .. yyh	30 bytes midi8/7-code
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted entirely as a single user program. The current program is not altered!

See also the following list "Program Structure".

SYSEX-FUNCTION "REQUEST ALL PROGRAMS DUMP":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
12h	function-code "request dump all programs"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transfer all three user program settings as a complete data record. In answer the DLS 223 transmits a Sysex record in the format "All Programs Dump".

See also the following list "Program Structure".

SYSEX-FUNCTION "ALL PROGRAMS DUMP": (transmitted and recognized)	
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
32h	function-code "dump all programs"
yyh .. yyh	90 bytes midi8/7-code
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted entirely in all three user programs. The current program is not altered!

See also the following list "Program Structure".

SYSEX-FUNCTION "REQUEST POWER-UP DATA DUMP": (recognized)	
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
13h	function-code "request dump power-up data"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transfer the switch-on status (MIDI Channel, Option parameter number, program number). In answer the DLS 223 transmits a Sysex record in the format "Power-up Data Dump".

SYSEX-FUNCTION "POWER-UP DATA DUMP": (transmitted and recognized)	
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
33h	function-code "dump power-up data"
yyh .. yyh	7 bytes midi8/7-code
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted as future Power-up status.

SYSEX-FUNCTION "REQUEST MIDI-EVENT LIST DUMP":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
16h	function-code "request dump MIDI-eventlist"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to transfer the learnt MIDI event list. In answer the DLS 223 transmits a Sysex record in the format "MIDI Event List Dump".

See also the following "Event List".

SYSEX-FUNCTION "MIDI-EVENT LIST DUMP": (transmitted and recognized)	
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
36h	function-code "dump MIDI-eventlist"
yyh .. yyh	28 bytes midi8/7-code
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted as a MIDI Event list. This new Event list takes effect immediately and previous MIDI Event data are overwritten.

See also the following "Event List".

SYSEX-FUNCTION "REQUEST STORE":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
15h	function-code "request store"
yyh	destination-number of program (1..3)
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to save the current audible program as a user program. Once the program has been saved the DLS 223 transmits a Sysex record in the format "Requested Store Processed".

SYSEX-FUNCTION "REQUESTED STORE PROCESSED":	(transmitted)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
35h	function-code "requested store processed"
F7h	message "end of system-exclusive"

Is transferred once the saving procedure has been carried out successfully via "Request Store".

SYSEX-FUNCTION "CALL PROGRAMM":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
17h	function-code "call program"
yyh	number of program to call (1..3 for user, 4..n for factory)
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to load a user or factory program as current audible program.

SYSEX-FUNCTION "REMOTE KEYPRESS":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
77h	function-code "remote keypress"
yyh	number of first key to press (see list below)
[yyh .. yyh]	value(s) of next following key(s) to press
F7h	message "end of system-exclusive"

This command is used for remote control of operation elements (keyboard, encoder).

[...] optional

SYSEX-FUNCTION "REMOTE ENCODER":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
78h	function-code "remote encoder"
yyh	value of first encoder-turn (7bit two's-complement)
[yyh .. yyh]	value(s) of next following encoder-turn(s)
F7h	message "end of system-exclusive"

This command is used for remote control of the encoder
[...] optional

SYSEX-FUNCTION "REQUEST COMPLETE EEPROM DUMP":	(recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
7Ah	function-code "request dump complete eeprom"
F7h	message "end of system-exclusive"

This command instructs the DLS 223 to dump the complete memory content. In answer the DLS 223 transmits a Sysex record in the format "Complete Eeprom Dump".

SYSEX-FUNCTION "COMPLETE EEPROM DUMP":	(transmitted and recognized)
F0h	message "system-exclusive"
30h	sysex-id "DYNACORD"
xxh	MIDI-channel (00h..0Fh for channel 1..16, 7Fh for all channels)
17h	device-id "DLS223"
79h	function-code "dump complete eeprom"
yyh .. yyh	147 bytes midi8/7-code
ssh	checksum of midi8/7-code
F7h	message "end of system-exclusive"

The data record supplied with this command is adopted as memory content. User programs, MIDI event list und Power-on status are thus overwritten. The current audible program is not altered!

PARAMETER-ADJUST-NUMBERS

Parameter no.	name	MIDI-range	Display option-mode no.	range
00h	distortion	00h...0Fh	01	0...15
01h	room	00h...0Fh	02	0...15
02h	rotor-balance	40h..00h..3Fh	03	-9..0..9
03h	speed bass	00h...7Fh	04	0...99
04h	speed treble	00h...7Fh	05	0...99
05h	slow/fast-ratio bass	00h...7Fh	06	0...99
06h	slow/fast-ratio treble	00h...7Fh	07	0...99
07h	speed-up bass	00h...7Fh	08	0...99
08h	speed-up treble	00h...7Fh	09	0...99
09h	speed-reduce bass	00h...7Fh	10	0...99
0Ah	speed-reduce treble	00h...7Fh	11	0...99
0Bh	rotate-direction bass	00h...01h	12	c / ac
0Ch	rotate-direction treble	00h...01h	13	c / ac
0Dh	frequency-vibrato bass	00h...0Fh	14	0...15
0Eh	frequency-vibrato treble	00h...0Fh	15	0...15
0Fh	vibrato-edge bass	00h...0Fh	16	0...15
10h	vibrato-edge treble	00h...0Fh	17	0...15
11h	panorama bass	00h...07h	18	0...7
12h	panorama treble	00h...07h	19	0...7
13h	front-back bass	00h...07h	20	0...7
14h	front-back treble	00h...07h	21	0...7
15h	room-back bass	00h...07h	22	0...7
16h	room-back treble	00h...07h	23	0...7
17h	crossover-frequency	00h...0Fh	24	0...15
18h	active-eq bass 30Hz	7Bh..00h..05h	25	-5..0..5
19h	active-eq treble 20kHz	7Bh..00h..05h	26	-5..0..5
1Ah	active-eq band 48Hz	7Bh..00h..05h	27	-5..0..5
1Bh	active-eq band 85Hz	7Bh..00h..05h	28	-5..0..5
1Ch	active-eq band 125Hz	7Bh..00h..05h	29	-5..0..5
1Dh	active-eq band 1,5kHz	7Bh..00h..05h	30	-5..0..5
1Eh	passive-eq bass	7Bh..00h	31	-5..0
1Fh	passive-eq mid	7Bh..00h	32	-5..0
20h	passive-eq treble	7Bh..00h	33	-5..0
21h	output-level	78h..00h..07h	34	--..0..7
22h	comb-delay bass	00h...1Fh	35	0...31
23h	comb-delay treble	00h...1Fh	36	0...31
24h	comb-depth bass	79h...00h	37	-7...0
25h	comb-depth treble	79h...00h	38	-7...0
26h	comb-direction treble	00h...01h	39	0 / 1
27h	stop-direction	00h...01h	40	0 / 1
28h	stop/start	00h...01h		
29h	slow/fast	00h...01h		
2Ah	effect off/on	00h...01h		

You will find the meanings of the parameters in chapter "Option".

h stands for hexadecimal values

EVENTLIST (MIDI-EVENTLIST-DUMP)

the eventlist consists of 12 words with 16bit each

event 0	effect on
event 1	prog1
event 2	prog2
event 3	prog3
event 4	stop
event 5	slow
event 6	fast
event 7	distortion
event 8	room
event 9	rotor-balance
event 10	speed bass
event 11	speed treble

each 16bit-word looks as follows:

```
1111 11
5432 1098  7654 3210
xxxx xxxx  yyyy yyyz
```

xx = learned MIDI-event   yy = learned data

00h	note-off	notenumber
01h	release	value
02h	note-on	notenumber
03h	velocity	value
04h	poly-pressure	notenumber
05h	poly-pressure	value
06h	controller 0	value
07h	controller 1	value
:		:
7Eh	controller 120	value
7Fh	program-change	value
80h	channel-pressure	value
81h	pitch-wheel	value
FFh	no event learned	7Fh

z = marks exact-trigger-event or besthit-range-event

PROGRAM-STRUCTURE (PROGRAM-DUMP)

each program consists of a 26 bytes parameter-set as shown:

byte 0	bit 7...0	system-internal (should not be changed)
byte 1	bit 7...4	active-eq bass 30Hz
byte 1	bit 3...0	system-internal (should not be changed)
byte 2	bit 7...4	active-eq band 48Hz
byte 2	bit 3...0	system-internal (should not be changed)
byte 3	bit 7...4	active-eq band 84Hz
byte 3	bit 3...0	system-internal (should not be changed)
byte 4	bit 7...4	active-eq band 125Hz
byte 4	bit 3...0	passive-eq bass
byte 5	bit 7...4	active-eq band 1,5kHz
byte 5	bit 3...0	passive-eq mid
byte 6	bit 7...4	active-eq treble 20kHz
byte 6	bit 3...0	passive-eq treble
byte 7	bit 7...4	distortion
byte 7	bit 3...0	room
byte 8	bit 7...0	rotor-balance
byte 9	bit 7...4	crossover-frequency
byte 9	bit 3...0	output-level
byte 10	bit 7...3	comb-delay treble
byte 10	bit 2...0	comb-depth treble
byte 11	bit 7...3	comb-delay bass
byte 11	bit 2...0	comb-depth bass
byte 12	bit 7...4	vibrato treble
byte 12	bit 3...0	vibrato bass
byte 13	bit 7...4	vibrato-edge treble
byte 13	bit 3...0	vibrato-edge bass
byte 14	bit 7	rotate-direction treble
byte 14	bit 6...4	panorama treble
byte 14	bit 3	rotate-direction bass
byte 14	bit 2...0	panorama bass
byte 15	bit 7...4	front-back treble
byte 15	bit 3...0	front-back bass
byte 16	bit 7...4	room-back treble
byte 16	bit 3...0	room-back bass
byte 17	bit 7...0	speed treble
byte 18	bit 7...0	speed bass
byte 19	bit 7...0	slow/fast-ratio treble
byte 20	bit 7...0	slow/fast-ratio bass
byte 21	bit 7...0	speed-up treble
byte 22	bit 7...0	speed-up bass
byte 23	bit 7...0	speed-reduce treble
byte 24	bit 7...0	speed-reduce bass
byte 25	bit 7	stop-direction
byte 25	bit 6	comb-direction treble
byte 25	bit 5...0	system-internal (should not be changed)

KEYBOARD-NUMBERS (REMOTE-KEYPRESS)

nr.	key	
01h	effect-on	
02h	prog1	
03h	prog2	
04h	prog3	
05h	distortion	
06h	room	
07h	rotor-balance	
08h	speed bass	
09h	speed treble	
0Ah	midi	
0Bh	store	
0Ch	stop	
0Dh	slow	
0Eh	fast	
0Fh	encoder-key	
10h	slow/fast footswitch	
11h	start/stop footswitch	
12h	midi + effect-on	(= learn event)
13h	midi + prog1	(= learn event)
14h	midi + prog2	(= learn event)
15h	midi + prog3	(= learn event)
16h	midi + stop	(= learn event)
17h	midi + slow	(= learn event)
18h	midi + fast	(= learn event)
19h	midi + distortion	(= learn event)
1Ah	midi + room	(= learn event)
1Bh	midi + rotor-balance	(= learn event)
1Ch	midi + speed bass	(= learn event)
1Dh	midi + speed treble	(= learn event)
1Eh	longpress midi + effect-on	(= forget event)
1Fh	longpress midi + prog1	(= forget event)
20h	longpress midi + prog2	(= forget event)
21h	longpress midi + prog3	(= forget event)
22h	longpress midi + stop	(= forget event)
23h	longpress midi + slow	(= forget event)
24h	longpress midi + fast	(= forget event)
25h	longpress midi + distortion	(= forget event)
26h	longpress midi + room	(= forget event)
27h	longpress midi + rotor-balance	(= forget event)
28h	longpress midi + speed bass	(= forget event)
29h	longpress midi + speed treble	(= forget event)
2Ah	longpress midi	(= forget all events)
2Bh	longpress speed bass + speed treble	(= option-mode)
2Ch	longpress store	(= restore all presets)
2Dh	longpress prog1	(= restore preset)
2Eh	longpress prog2	(= restore preset)
2Fh	longpress prog3	(= restore preset)
30h	longpress distortion + speed treble	(= service)
32h	encoder one step up	
33h	encoder one step down	
34h	service-key index	
35h	service-key value	

MIDI8/7-CODE

a transfer of seven 8bit-databytes via MIDI-sysex affects in transmission of eight MIDI-data-bytes (with MSB=0) according to the following pattern:

   AAAAaaaa BBBBbbbb CCCCcccc DDDDdddd EEEEeeee FFFFffff GGGGgggg

          gets to

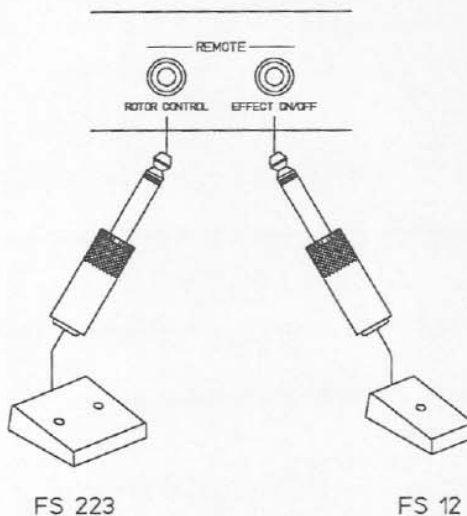0GFEDCBA 0AAAaaaa 0BBBbbbb 0CCCcccc 0DDDdddd 0EEEeeee 0FFFffff 0GGGgggg

       (first ------------- last transmitted)

The checksum transmitted finally is the 2's-complement of the 7bit-sum of all the MIDI8/7-data before.

8. REMOTE CONTROL

8.1 REMOTE CONNECTIONS:

Different DLS 223 functions can be remote controlled via foot switch.

FS 223   FS 12

ROTOR CONTROL - When the double foot switch FS 223 is connected to this socket, both treble and bass rotors can be switched together. The functions ROTOR-ON/OFF and FAST/SLOW are thus possible. The status is indicated by the 3 LED's on the front panel.

EFFECT ON/OFF - When the foot switch FS 12 is connected to this socket it is possible to switch from original to effect signal (see front panel key (4.1)). The status is indicated by the Status LED on the front panel.

Note:

Other foot switches can be used apart from the FS 223 and FS 12 specified here, the only precondition being that it must be a momentary switch rather than a latching switch and the contact must be closed on activation!

9. APPENDIX

Operation of the DLS 223 was designed in such a way that all functions and parameters are quickly and easily accessible. The idea was based on various organ cabinets and the DYNACORD Simulator CLS 222.

For our simulation purposes we did, however, eliminate all the various noises connected with these "ancient dinosaurs!"

The DLS was equipped with MIDI control possibilities and additional programs to utilize the unique rotor effect with more modern instruments (organs, keyboards, computers ...) more efficiently. Identifying all the parameters hidden under Options and Sysex should really be a delight for sound sleuths!

As younger contemporaries are only familiar with these cabinets from records and CD's we have included a brief description of the mechanics and sound properties thereof.

In the Sixties to the mid-Seventies, the heyday of cabinets, there was an enormous variety of types and manufacturers. The pictures above correspond with the most common forms produced. The dimensions measured approx. 80 x 60 cm, the height between 100 and 150 cm. The cabinets weighed anything between 40 and 100 kg.

A frequency crossover was used to supply the two loudspeakers, the bass rotor below and the treble rotor above with organ signals via power amplifiers integrated in the cabinets. The rotors were partially located in two separate housings to facilitate transportation.

Sound guide drums (low frequency) and horns were mounted in front of the loudspeaker membranes or compression drivers. These were pivotable so that the sound could be reflected in all directions, driven by two (sometimes four) motors. These rotating sound sources led to the unmistakeable sound of the rotor cabinets.

Important contributory physical effects included: Doppler effect (pitch jumps) when passing the listener, panorma effect via direct and lateral sound emission and room effect due to the creation of a lot of reflections when the rotors were facing towards the rear. Interference sounds resulted from the slightly varying speeds of the two rotors. This effect is especially marked when the speed is switched over from stop - slow - fast, as the variety of varying differences crop up due to the differing rotor masses.

The materials used for housing, loudspeakers and rotors, along with the finish of the materials, play an important role in the characteristic sound effects produced. Rotors were made of wood, cardboard, polystyrene, aluminium and plastic.

All the above-mentioned effects and peculiarities were examined and taken into consideration for simulation purposes involving the DLS 223.

9.1 WHAT IS MIDI?

As the name already says MIDI (Musical Instrument Digital Interface) is a standardized data interface for musical instruments and devices.

In the normal MIDI standard, MIDI controllers, MIDI switches, MIDI Note Numbers etc. are determined. As in computer technology, all Midi Events are given a certain address (byte sequence) which is recognized by all functional MIDI interfaces alike. MIDI means a language with which devices made by different manufacturers can communicate on a common level.

Normally speaking MIDI is used to play additional devices such as expanders, samplers, synthesizers etc. from a keyboard. Information such as the notes played, the position of the modulation wheel, the position of a foot controller, velocity of key activation etc. are transmitted by MIDI to the units connected.

Effect units like the DLS 223 can also be subjected to MIDI control. Users can program it in such a way that the appropriate effect is always selected when a synthesizer sound is called up. That is possible because the synthesizer always transmits a command to change the program at sound selection. The DLS 223 receives this program change command and then calls up the program allocated to the command in question.

The MIDI specification includes 16 different channels. A MIDI transmitter can control up to 16 different MIDI receiving units completely independently of each other, all at the same time. You can set the MIDI reception channel on the DLS 223 (see chapter 7.1). For correct MIDI transmission you must make sure that the appropriate MIDI channel has also been set on the transmitting unit (keyboard, sequencer, computer). Please read the user manuals of the units in question.
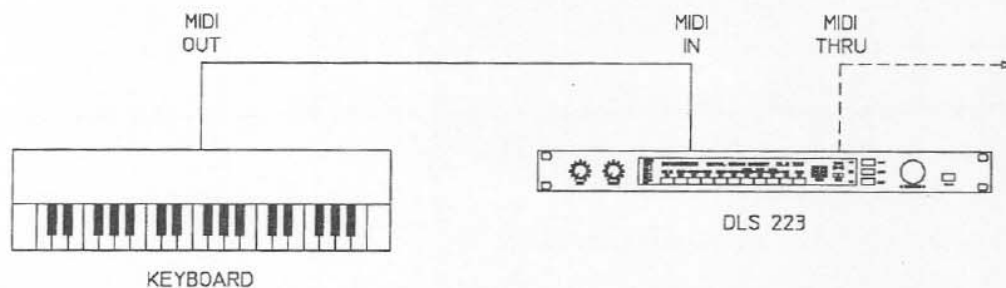
10. SPECIFICATIONS

|		
Mains voltage	90-250 VAC/50-60 Hz (without switching over)	
Power consumption	max. 13 VA	
Safety class	I	
Input voltage	HI	0.775 V / 0 dBm
	LO	80 mV / -20 dBm
Max. Input voltage		9 V / +21 dBm
Input impedance	LO/HI	50 kohms
Output voltage		3.2 V / +12 dBm
Output impedance		120 ohms
Frequency response original	20 Hz - 20 kHz +0 / -1 dB	
Frequency response effect	20 Hz - 20 kHz +0 / -3 dB	
S/N ratio original	> 104 dB	
S/N ratio effect	> 90 dB	
Distortion (THD) original	< 0.003 %	
Distortion (THD) effect	< 0.05 %	
Data format	16 bit linear, internally 24 bit	
MIDI connections	IN/OUT/THRU	
Ground lift	Separates circuit ground from housing	
Dimensions (WxHxD in mm)	483 x 43.6 x 225, 1 HU	
Weight	3.5 kg / 7.7 lbs	
Accessory	FS 223 (Motor ON-OFF / FAST-SLOW)	
	FS 12 (Effect off)	

The specifications for this product are subject to change without prior notice.

BLOCK DIAGRAM
DLS 223
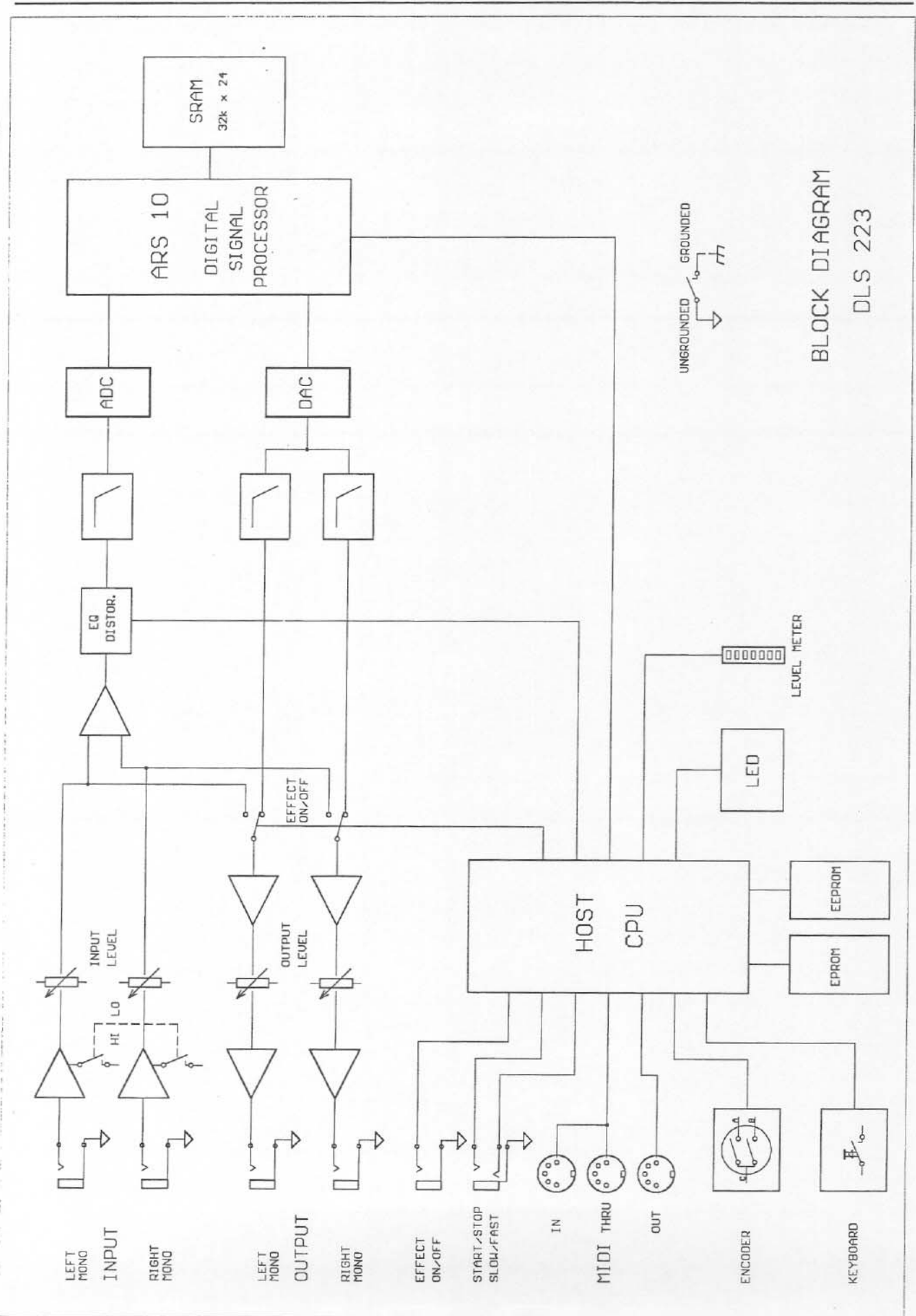
DIMENSIONS (in mm)
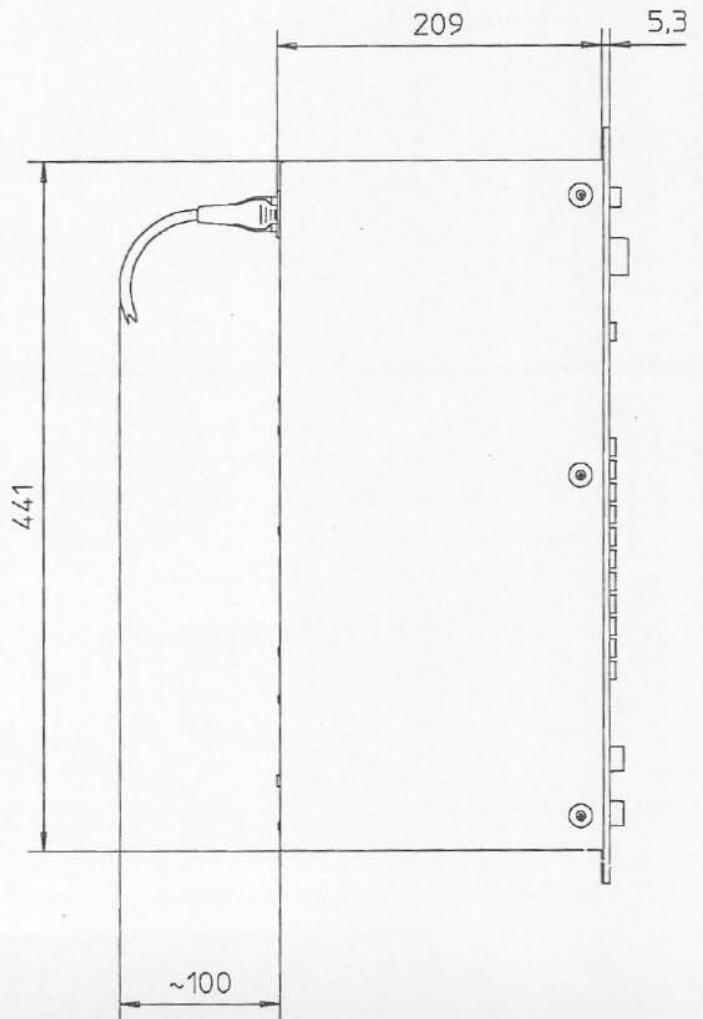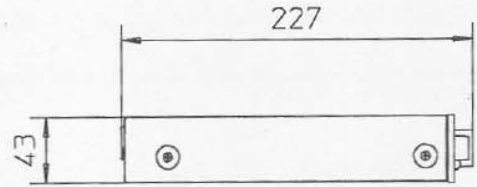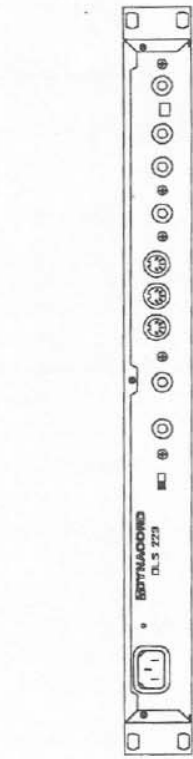
MEASURING DATA DLS 223

Agreements:

- All Level, Frequency Response and Distortion Measurements are performed with "AUDIO PRECISION SYSTEM ONE". Generator impedance 25 ohms, Analyzer impedance 100 kohms.
- Levels measured with f=1 kHz.
- The noise levels measured at the outputs refer to the nominal output level of +12dBm.
- Tolerances of the level values: +/- 1 dB.
- All Distortion measurements are performed with a measurement bandwidth of 10 Hz - 22 kHz, without filter. Measured is THD+Noise.
- Measurements at the original signal with EFFECT OFF.
- 0 dBu = 775 mV rms
- Operating voltage and current are measured with "PHILIPS MULTIMETER PM 2517X".
- Power Consumtion is measured with "Zäres Wattmeter".
- Recall of the Service Presets:
- Press simultaneously the keys "DISTORTION" and "SPEED TREBLE" over a long time; switch with key "SPEED TREBLE" under index number "00" to service preset selection and select the desired program with the rotary encoder.

1. Operating voltage $EB_{(V)}$ 90 - 250 V_{AC} f = 50 - 60 Hz

2. Operating current $IB_{(A)}$

at 110 V_{AC}	150 mA
at 230 V_{AC}	110 mA

3. Power consumption

at 110 V_{AC}	10.5 VA
at 230 V_{AC}	12.5 VA

4. Inputs

  - both inputs connected (Stereo operation)

4.1. Input impedance Z_I = 50 kohms

4.2. Input voltage

  - input level switch position HI.

E_I	= 775 mV = 0dBm
E_{Imax}	= 1.55 V = +6dBm

  - input level switch position LO.

E_I	= 95 mV = -18dBm
E_{Imax}	= 175mV = -12dBm

5. Outputs

- both outputs connected (Stereo operation)

- the output levels measured refer to an input level of EI = 0dBm and EImax = +6dBm. Input and output level controls fully to the right, input selector into position HI.

5.1. Output impedance	Z_O	= 120 ohms
5.2. Output voltage left:	E_O	= 3.2 V = +12dBm
	E_{Omax}	= 6.4 V = +18dBm
5.3. Output voltage right:	E_O	= 3.2 V = +12dBm
	E_{Omax}	= 6.4 V = +18dBm

5.4. Frequency response

5.4.1 Frequency response - original signal

- Input level selector into position HI, effect OFF.

- Input level 0dBm.

- Input control fully right, output control adjusted to 0dBm.


```
DLS 223   FREQRESP AMPL(dBr) vs FREQ(Hz)              18 MAY 93 07:26:51
```
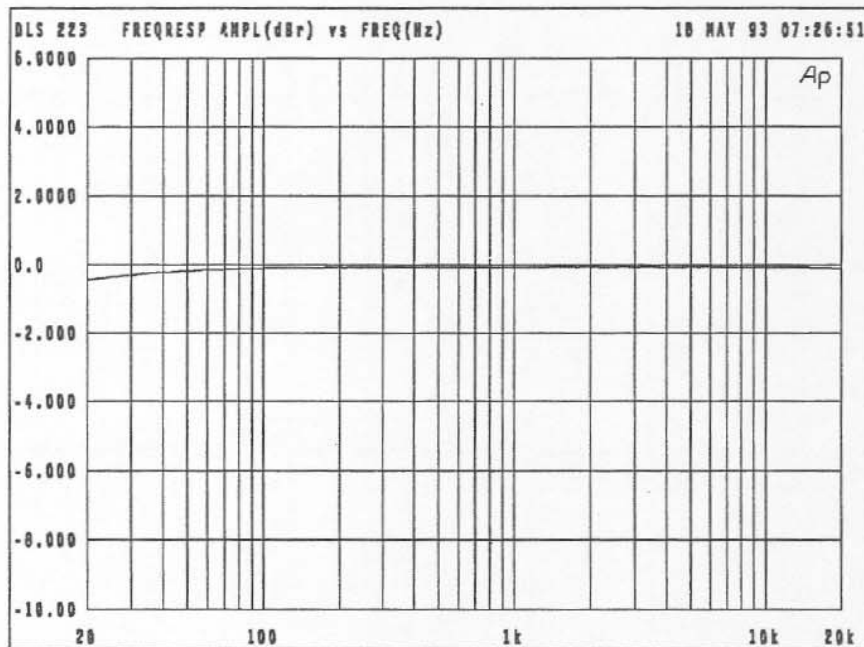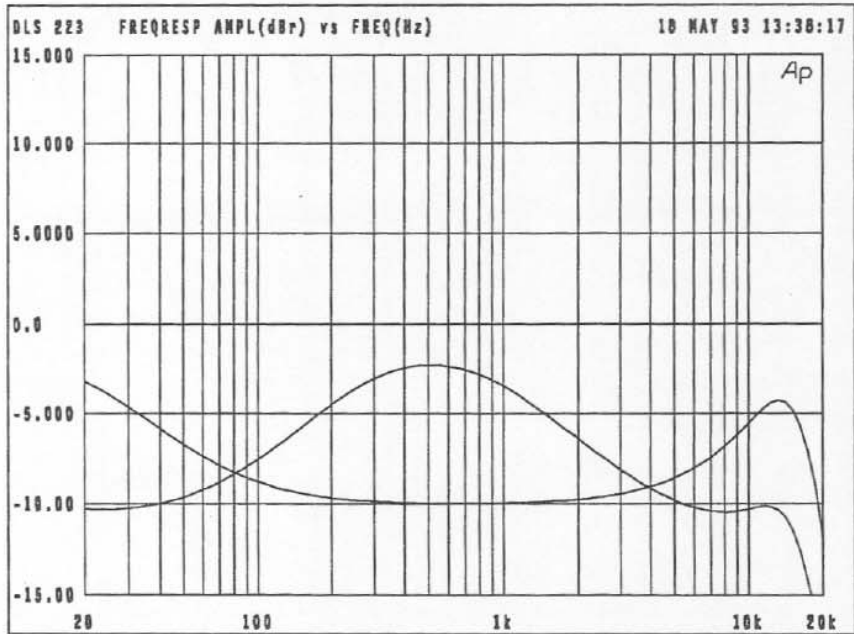
5.4.2 Frequency response - effect signal

- Input level selector into position HI, effect ON.

- Service preset 01 recalled.

- Input level 0dBm.

- Input control fully right, output control adjusted to 0dBm.
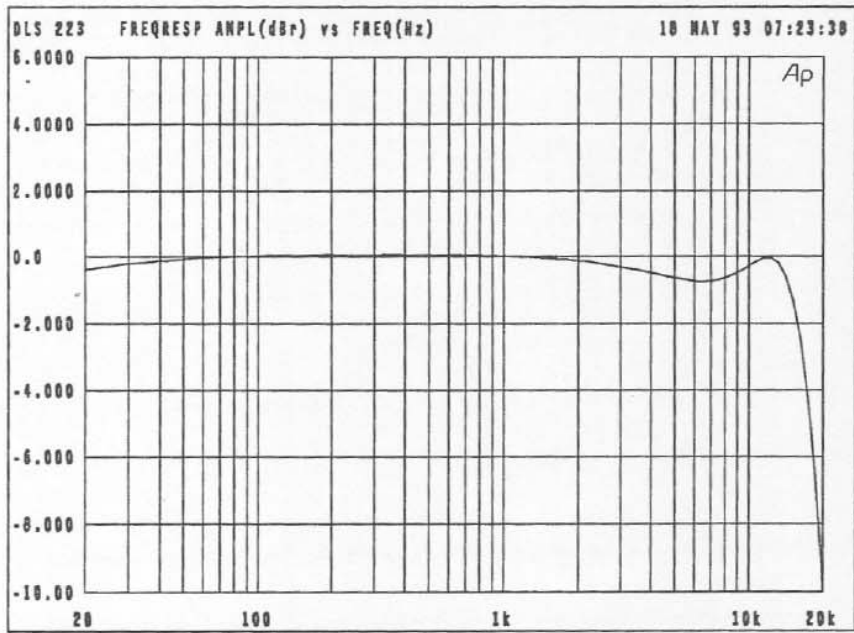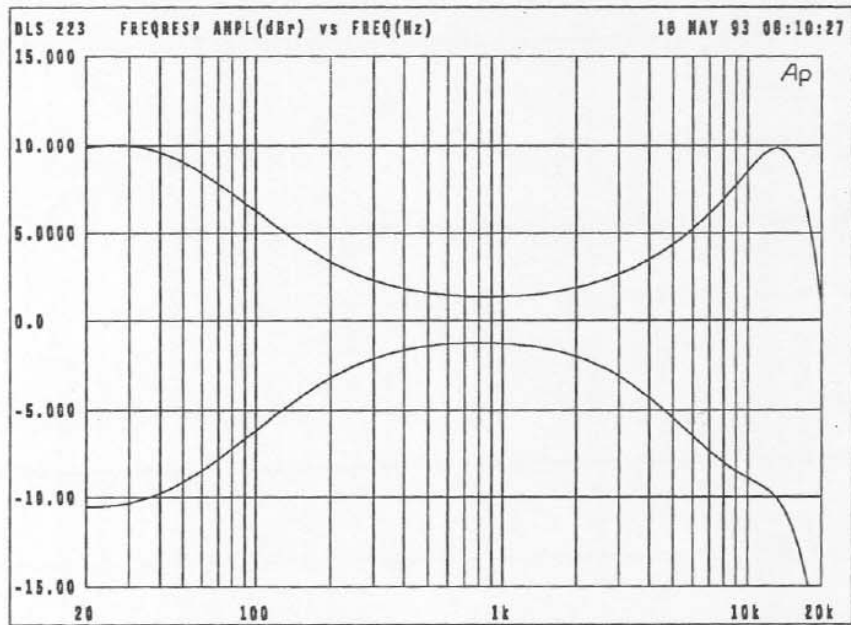
5.4.3 Frequency response - EQ

- Input level selector into position HI, effect ON.

- Input level -6dBm.

- Input control fully right, output control adjusted to 0dBm.

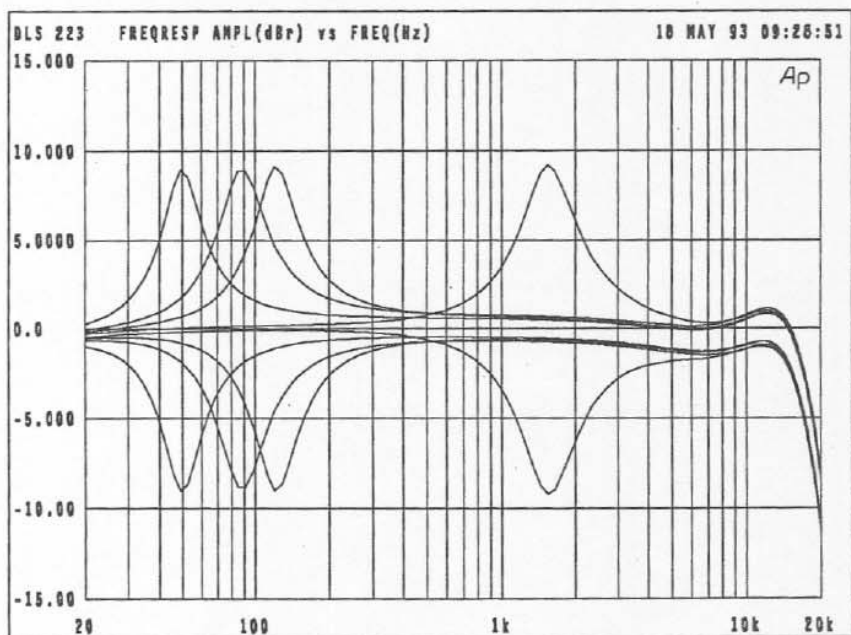**EQ controls pre distorter**

Plot 1: Service preset 08 recalled

Plot 2: Service preset 09 recalled

DLS 223   FREQRESP AMPL(dBr) vs FREQ(Hz)   18 MAY 93 08:10:27

EQ controls post distorter
Plot 1: Service preset 10 recalled
Plot 2: Service preset 11 recalled

DLS 223   FREQRESP AMPL(dBr) vs FREQ(Hz)   18 MAY 93 09:28:51
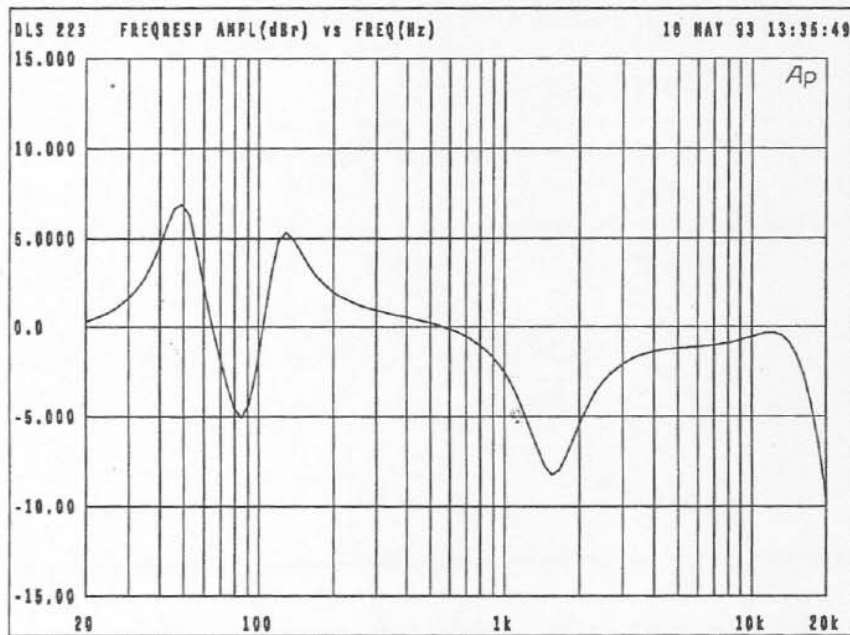
Frequency response of the EQ
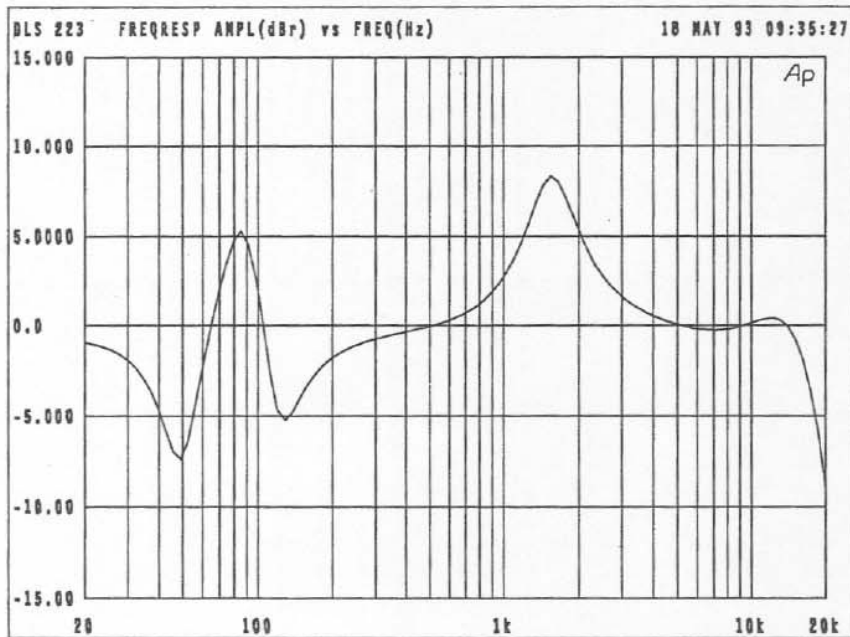
- Service preset 01 recalled

Plot 1:   48Hz Param. control 27 (+/-5)
Plot 2:   85Hz Param. control 28 (+/-5)
Plot 3: 125Hz Param. control 29 (+/-5)
Plot 4: 1.5kHz Param. control 30 (+/-5)

DLS 223   FREQRESP AMPL(dBr) vs FREQ(Hz)   18 MAY 93 13:35:49

Frequency response of the EQ

- Service preset 13 recalled

DLS 223   FREQRESP AMPL(dBr) vs FREQ(Hz)   18 MAY 93 09:35:27
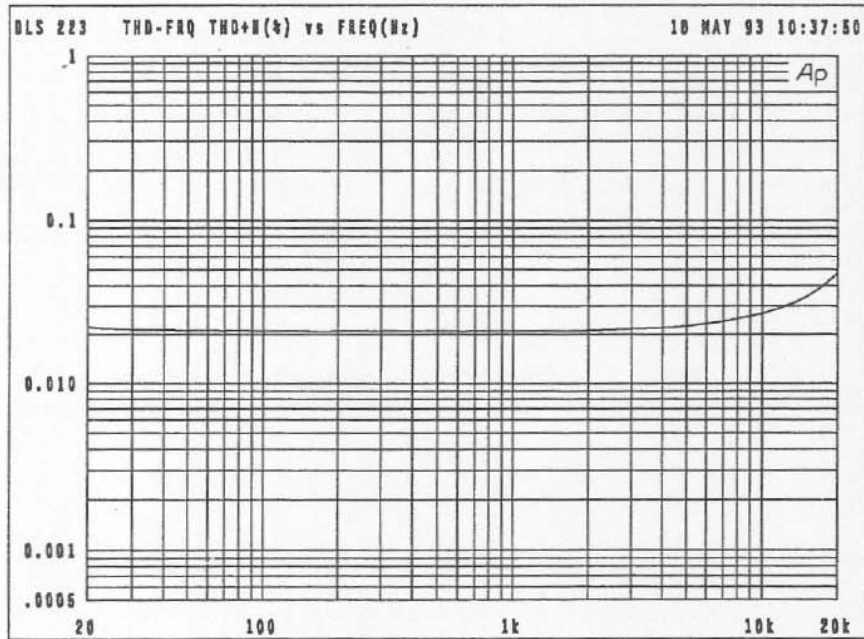
Frequency response of the EQ

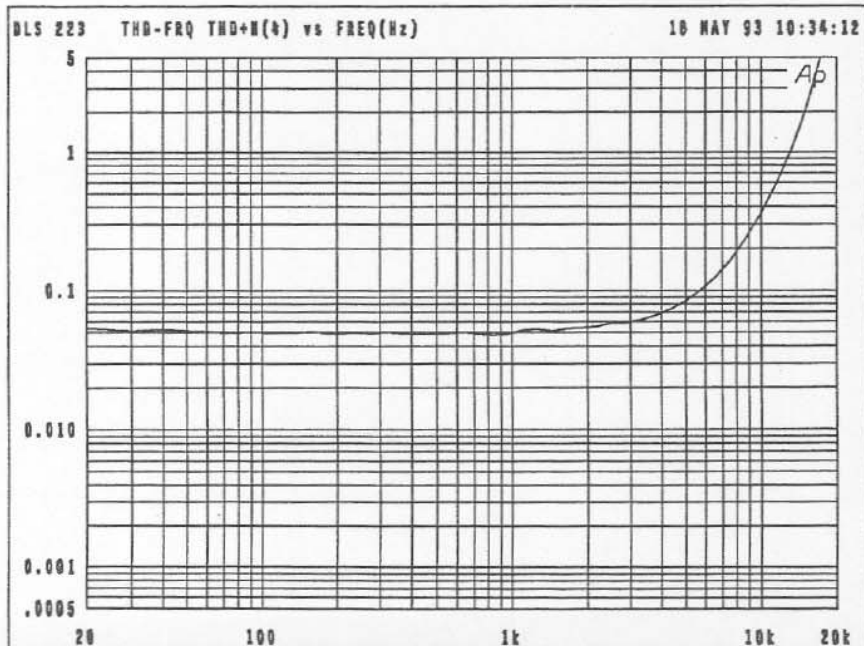- Service preset 14 recalled

5.5. Distortion (THD)

5.5.1 Distortion (THD) - original signal

- Input level selector into position HI, effect OFF.

- Input level +10dBm.
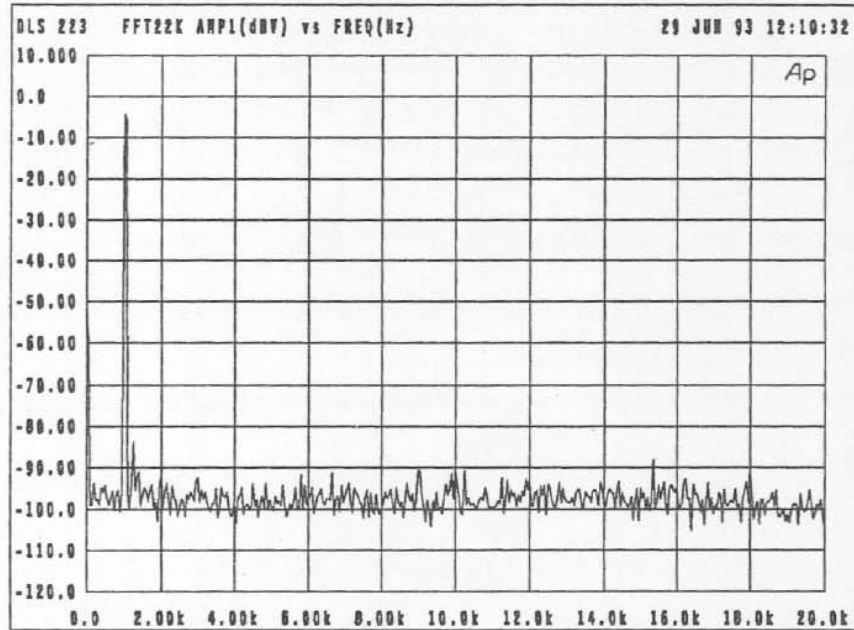
- Input and output controls fully right.

5.5.2 Distortion (THD) - effect signal

- Input level selector into position HI, effect ON.

- Input level -10dBm.
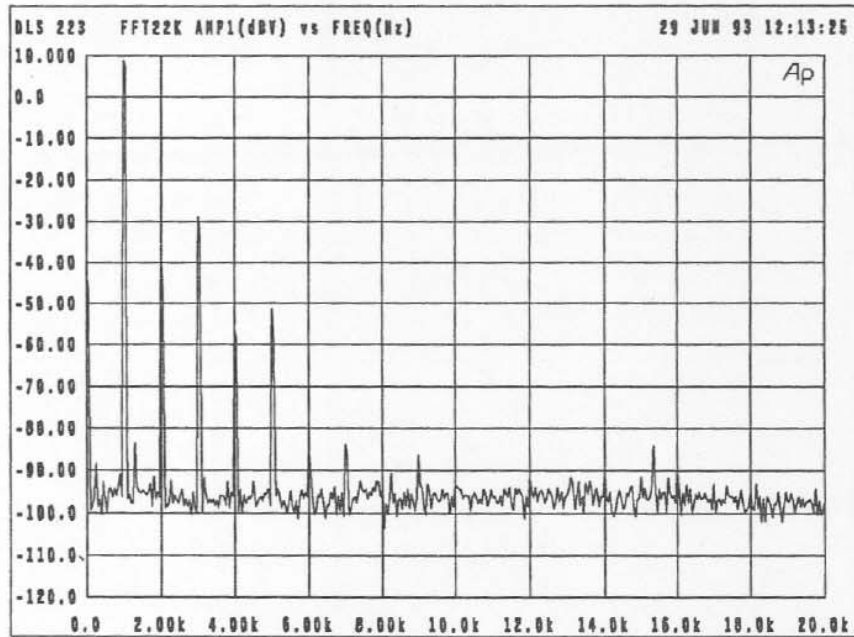
- Service preset 01 recalled.
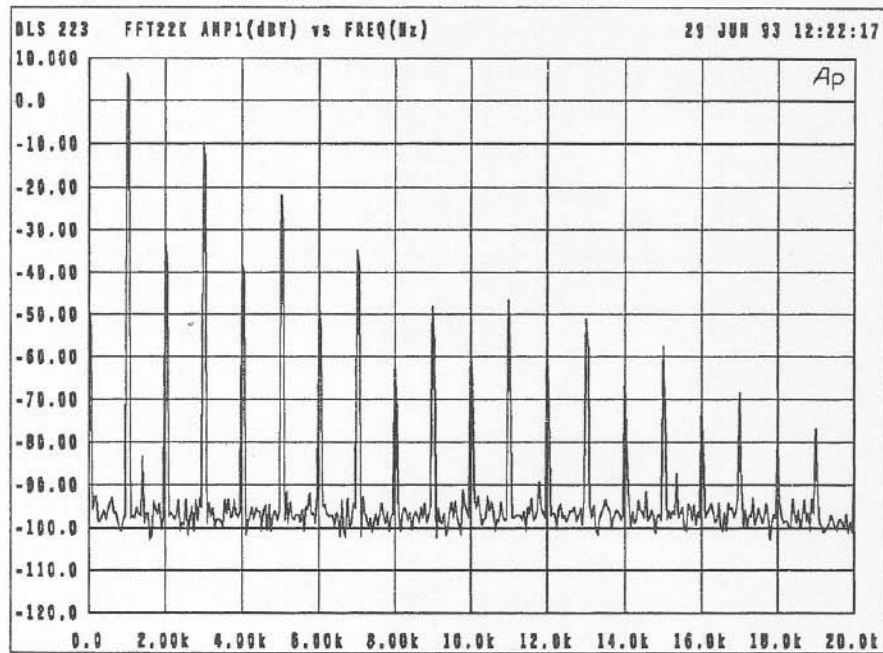
5.5.3 Distortion (THD) - Distortion

- Input level selector into position HI, effect ON.

- Input level -14dBm.

- Input and output controls fully right.

- Service preset 01 recalled

(Distortion control in position 0)

- Service preset 16 recalled

(Distortion control in position 5)

BLS 223   FFT22K AMP1(dBV) vs FREQ(Hz)   29 JUN 93 12:22:17

- Service preset 17 recalled

(Distortion control in position 15)

5.6. Noise voltages

- All specifications are valid for the left and right output
- Service preset 01 recalled

5.6.1. Noise voltage - original signal

- Input level selector into position HI, effect OFF.

E_O weight.(RMS)	15µV	112dB
E_{noise} (Q-peak)	32µV	106dB
E_{CCIR} (Q-peak)	65µV	100dB

- Input level selector into position LO, effect OFF.

E_O weight.(RMS)	85µV	96dB
E_{noise} (Q-peak)	200µV	90dB
E_{CCIR} (Q-peak)	400µV	84dB

5.6.2. Noise voltage - effect signal

- Input level selector into position HI or LO, effect ON.

E_O weight.(RMS)	150µV	91dB
E_{noise} (Q-peak)	350µV	85dB
E_{CCIR} (Q-peak)	650µV	80dB

5.7. Crosstalk

between left and right   > 70dB

47

Service functions DLS223 Version 1.0

Recall of the Service Mode by pressing the keys "DISTORTION" and "SPEED TREBLE" simultaneously over a long time. Exit of Service Mode by pressing the key "STORE".

Parameter Values in the Service Mode

SPEED BASS	SPEED TREBLE
Index	Date

Index	Parameter	Value
00	PRESET-RECALL (see listing Service ROM Presets)	
01	DISTORTION	(0...15)
02	ROOM	(0...15)
03	ROTOR-BALANCE	(80h...7Fh)
04	SPEED BASS	(00h...FFh)
05	SPEED TREBLE	(00h...FFh)
06	SLOW/FAST-RATIO BASS	(00h...FFh)
07	SLOW/FAST-RATIO TREBLE	(00h...FFh)
08	SPEED-UP BASS	(00h...FFh)
09	SPEED-UP TREBLE	(00h...FFh)
10	SPEED-REDUCE BASS	(00h...FFh)
11	SPEED-REDUCE TREBLE	(00h...FFh)
12	ROTATE-DIRECTION BASS	(C / AC)
13	ROTATE-DIRECTION TREBLE	(C / AC)
14	FREQUENCY-VIBRATO BASS	(0...15)
15	FREQUENCY-VIBRATO TREBLE	(0...15)
16	VIBRATO-EDGE BASS	(0...15)
17	VIBRATO-EDGE TREBLE	(0...15)
18	PANORAMA BASS	(0...7)
19	PANORAMA TREBLE	(0...7)
20	FRONT-BACK BASS	(0...7)
21	FRONT-BACK TREBLE	(0...7)
22	ROOM-BACK BASS	(0...7)
23	ROOM-BACK TREBLE	(0...7)
24	CROSSOVER-FREQUENCY	(0...15)
25	ACTIVE-EQ BASS 30HZ	(-5..0..5)
26	ACTIVE-EQ TREBLE 20KHZ	(-5..0..5)
27	ACTIVE-EQ BAND 48HZ	(-5..0..5)
28	ACTIVE-EQ BAND 85HZ	(-5..0..5)
29	ACTIVE-EQ BAND 125HZ	(-5..0..5)
30	ACTIVE-EQ BAND 1,5KHZ	(-5..0..5)
31	PASSIVE-EQ BASS	(-5...0)
32	PASSIVE-EQ MID	(-5...0)
33	PASSIVE-EQ TREBLE	(-5...0)
34	OUTPUT-LEVEL	(--..0..7)
35	COMB-DELAY BASS	(0...31)
36	COMB-DELAY TREBLE	(0...31)
37	COMB-DEPTH BASS	(-7...0)
38	COMB-DEPTH TREBLE	(-7...0)
39	COMB-DIRECTION TREBLE	(0 / 1)
40	STOP-DIRECTION	(0 / 1)
41	BASS POSITION	(bass rotor in the tens digit
42	TREBLE POSITION	and the horn rotor in the units digit
43	BASS TACHO	(00h...FFh, display, no Edit)
44	TREBLE TACHO	(00h...FFh, display, no Edit)

45	PEAKHOLD-TIME	(00h...FFh)
46	MIDI-SYSEX-REMOTE ENABLE	(0 / 1)
47	VU-SELEKTION	(i/o/L/r and combinations)
48	EQ-GAIN F1	(-5...5) Gain correction
49	EQ-GAIN F2	(-5...5) Bass 30Hz
50	EQ-GAIN F3	(-5...5) Band 48Hz
51	EQ-GAIN F4	(-5...5) Band 85Hz
52	EQ-GAIN F5	(-5...5) Band 125Hz
53	EQ-GAIN F6	(-5...5) Band 1,5kHz
54	EQ-GAIN F7	(-5...5) Treble 20kHz
55	EQ-GAIN F1*	(-5...5) Distortion in
56	EQ-GAIN F2*	(-5...5) Distortion out
57	EQ-GAIN F3*	(-5...5) Compensation in
58	EQ-GAIN F4*	(-5...5) Compensation out
59	EQ-GAIN F5*	(-5...5) Bass cut 30Hz
60	EQ-GAIN F6*	(-5...5) Middle cut 800Hz
61	EQ-GAIN F7*	(-5...5) Treble cut 18kHz
62	SERVICE RECALL	(see listing Service Routines)

Service ROM Presets DLS223

Presets are selected via Index 00. Presets are called up using the rotary encoder and are immediately valid without confirming with Enter. These presets can be edited and stored as usual.

SPEED TREBLE
Number

1	Original Through (EQ linear)
2	Original Through only Right (EQ linear)
3	Original Through only Left (EQ linear)
4	Muted
5	Sine Output Left and Right
6	Sine Output only Right
7	Sine Output only Left
8	Frequency Response Bass and Trebles cut
9	Frequency Response Middle cut
10	Frequency Response Bass and Trebles boost
11	Frequency Response Bass and Trebles cut
12	Frequency Response Bands Pattern 1
13	Frequency Response Bands Pattern 2
14	Frequency Response all Bands fully cut
15	Frequency Response all Bands fully boosted
16	Original Through with Distortion 5
17	Original Through with Distortion 15
18	Level correction boosted individually
19	Level correction cut individually
20	Compensation in/out individually
21	Distorrtion in/out individually
22	Clean Leslie, only bass rotor, crossover minimum
23	Clean Leslie, only horn rotor, crossover minimum
24	Clean Leslie, only bass rotor, crossover maximum
25	Clean Leslie, only horn rotor, crossover maximum

Service Routines DLS 223

Service Routines are called up via Index 62. Pressing the "STORE" key starts up a Service Routine, but only if the Service Routine number is indicated (Index 62, Speed Treble flashes on and off).

| SPEED	STORE
TREBLE	
Number	Execution

0   NO CHANGE RETURN

1   SOFTWARE RESET

2   DISPLAY SOFTWARE VERSION

3   DISPLAY ROM CHECK SUM
     Output of the 16 bit-wide additive 8 bit check sum of the EPROM 27256 (address range
     8000h...FFFFh) as 2 successive Hex figures (MSByte, LSByte) in the seven-segment display.

4   EEPROM TEST WITHOUT LOSS OF DATA
     The current EEPROM content is saved in the ARS system, two inverse test patterns are written,
     verified and subsequently the original data from the ARS system is written back. While this
     procedure is in progress, the decimal point of the 10th digit lights up. If the decimal point goes off
     afterwards, the procedure was Ok. If the decimal point flashes on and off constantly, (even in
     normal operation), this indicates an EEPROM error. The real EEPROM test via test pattern does
     not depend on the function of the ARS system, as this is only used as an intermediate memory
     for the current data. If the ARS system is not working, the EEPROM data is lost nevertheless.

5   SAVE EEPROM DATA VIA SYSEX
     The current EEPROM content is transmitted to the Midi Output via MIDI system exclusive
     messages, without involving the ARS system. This data can be recorded and later played back
     into the unit. The ARS system must be working, however, for this procedure to be carried out.

6   DELETING EEPROM DATA
     The current EEPROM content is deleted completely (returns to original). The DLS223 then reads
     all data from the EPROM.

7   LED TEST PATTERN
     The following test patterns are issued to the LED driver: 111111... (= all LED's light up).
     101010... (every second LED lights), 010101... (= every second LED dark), 000000...
     (= all LED's dark).

8   MIDI TEST 31.25 kBAUD WITH EXTERNAL CLOCK DIVIDER
     A test pattern is issued at the MIDI OUT and is then checked at the MIDI IN. Therefore a
     connection between MIDI OUT and MIDI in must be made. When all displays go dark briefly,
     and the unit resumes its normal function, the test was OK. The seven-segment display indicates
     the following possible errors: "E.1" for Timeout Error, "E.2" for Framing Error, "E.3" for Data Error
     and "E.4" for Overrun Error.

9   MIDI TEST 62.5 kBAUD WITH INT. CLOCK DIVIDER
      As before, whereas here, the CPU internal frequency divider is used instead of the CPU external
      frequency divider (./.4) .

10   KEYBOARD TEST
      The keyboard is interrogated without software debouncing and one number of whatever key has
      been pressed is indicated in the display. In the case of keys on the front PCB, the corresponding
      LED is also activated. The key number "00" represents "no key pressed" and "--" for "several keys
      pressed". The Remote foot switches and not printed Service keys are also numbered, resulting in
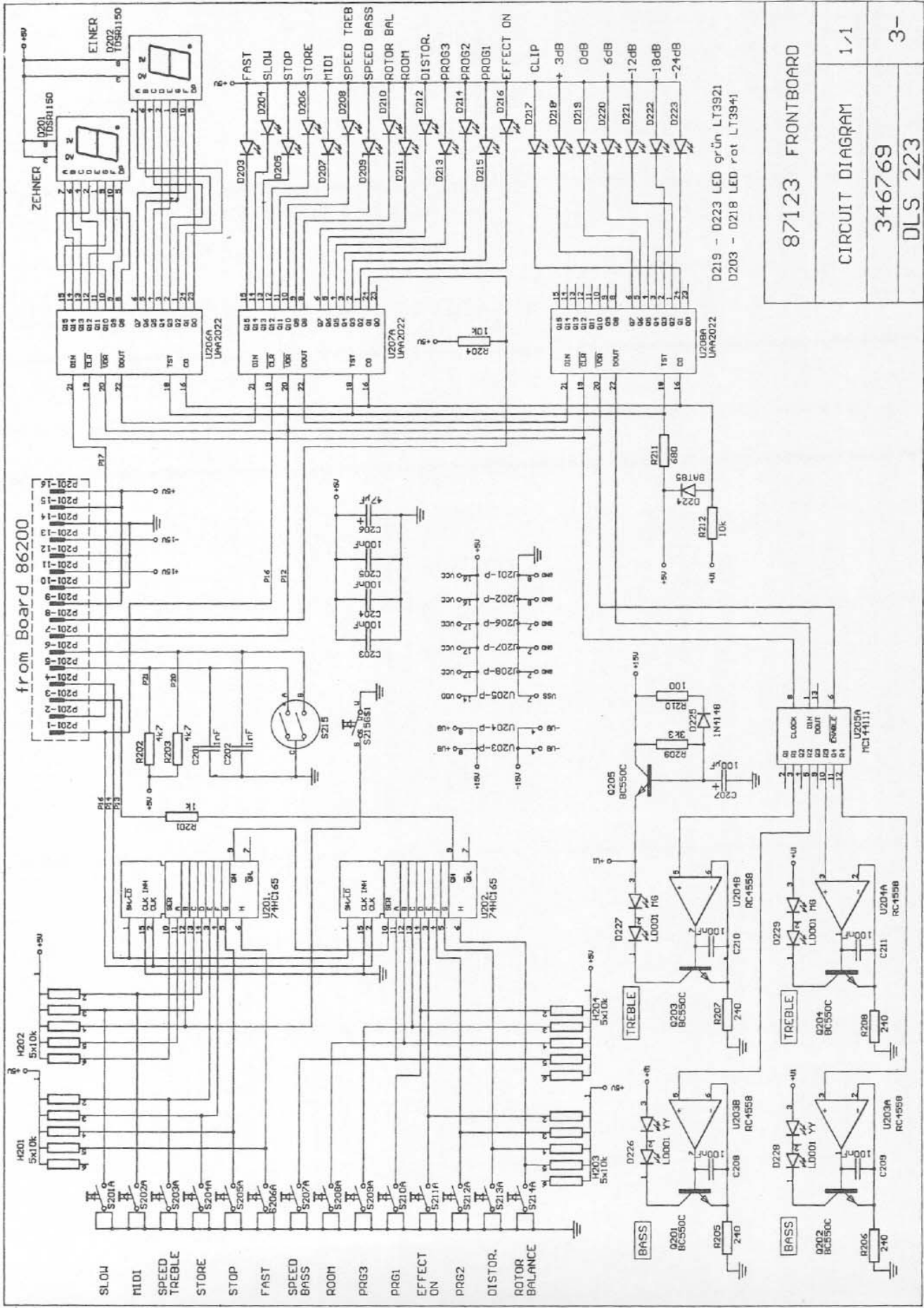   the key numbers "01" to "24". This test is only concluded with Hardware Reset (Power Off).
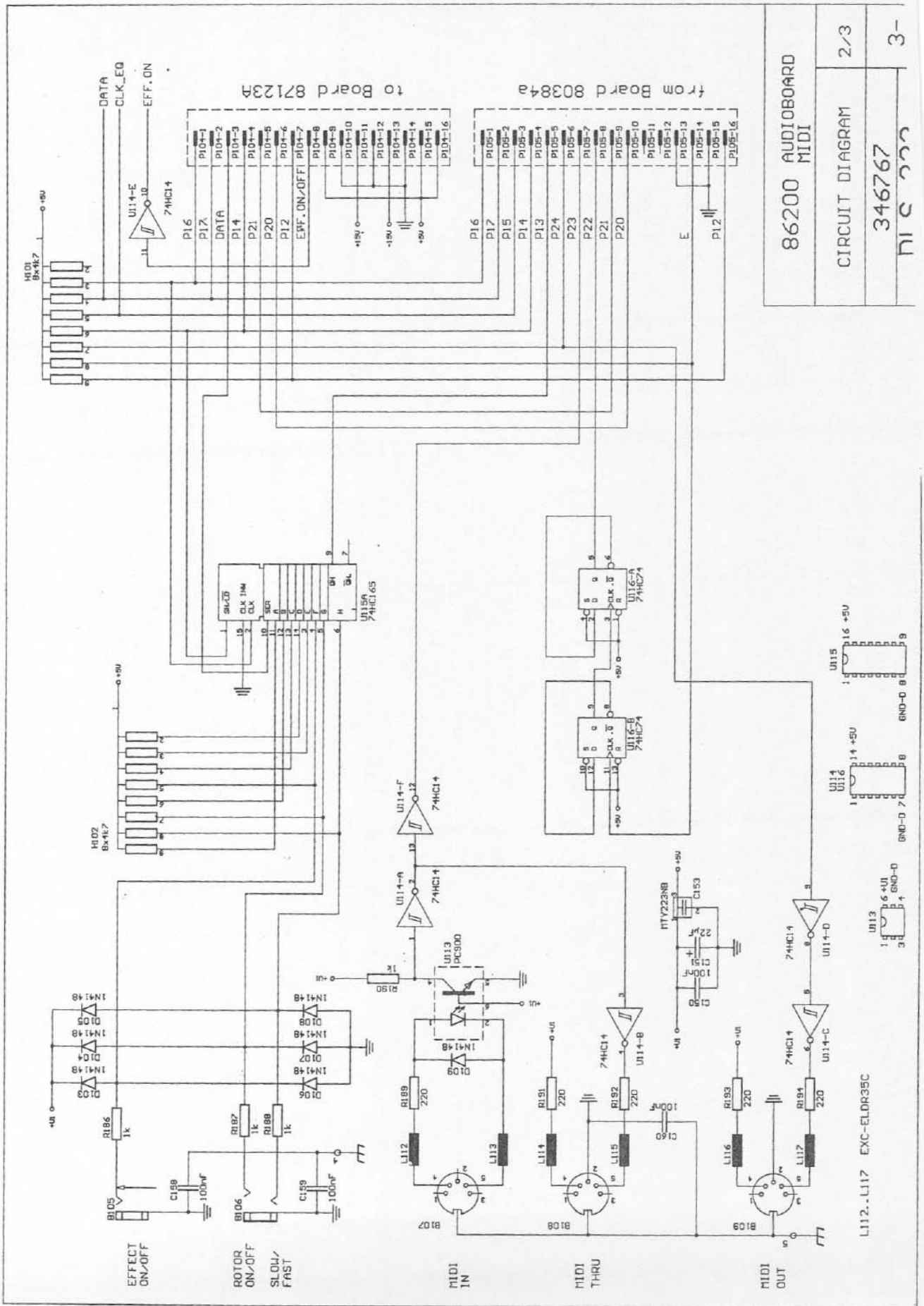
CIRCUIT DIAGRAM

86200 AUDIOBOARD
MIDI

2/3

346767

3-

86200 AUDIOBOARD EQUALIZER
CIRCUIT DIAGRAM 3/3
346767
DLS 223

87123 FRONTBOARD

CIRCUIT DIAGRAM 1/1

346769

DLS 223

3-

to Board 80384a

EQIN
EQOUT

J101 geschlossen, EQ on

J102 geschlossen, EQ off

EFF. ON

16-poliges DIP-Verbindungskabel zuischen P101 und P102

INPUTLEVEL OUTPUTLEVEL

AC VOLTAGE 1000 HZ, MEASURED WITH VTVM

INPUT LEFT

INPUT RIGHT

OUTPUT LEFT

OUTPUT RIGHT

L101..L108 EXC-ELDR35C

CIRCUIT DIAGRAM

PCB B0384a

344 174

RDP 2

2-

LINE FILTER
85232

90 - 250V AC
50 - 60 Hz

POWER SUPPLY
346 713

AC1
AC2

L
N

U2
U3
GND
GND
U1

GND
+5U
GND
-15U
+15U

B
A
D
E
C

P106

RDP 2
80384b

P101

P104

P105

P102

P103

LEFT OUT
GND-A2
RIGHT OUT
GND-A2
LINE IN
GND-A

P103

AUDIOBOARD
REAR
86200.1

P101

P102

AUDIOBOARD
FRONT
86200.2

P201

DISPLAYBOARD
FRONT
87123a
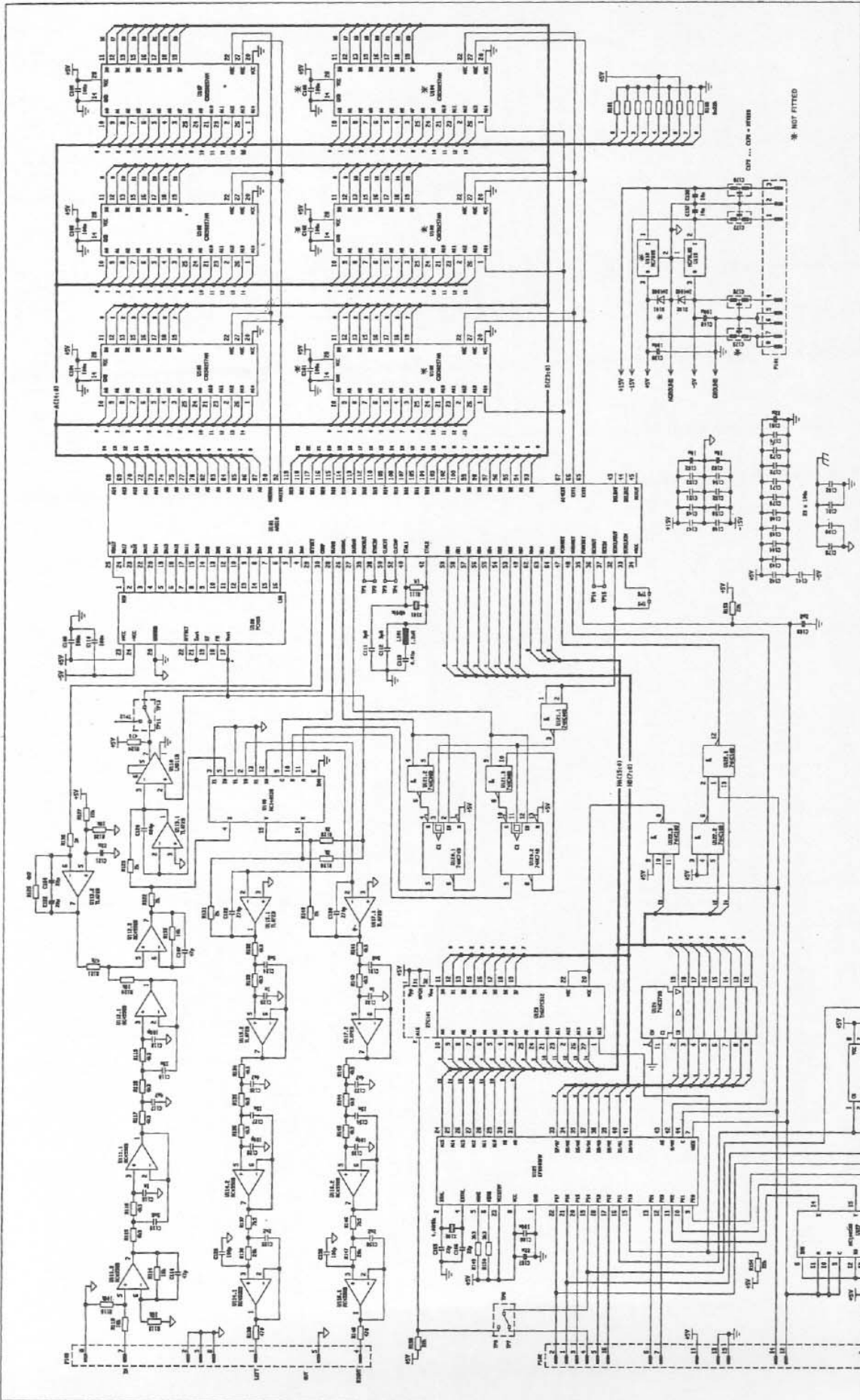
DLS_UERB

BLOCK DIAGRAM

346 877

DLS 223

3-

LINE FILTER   85232
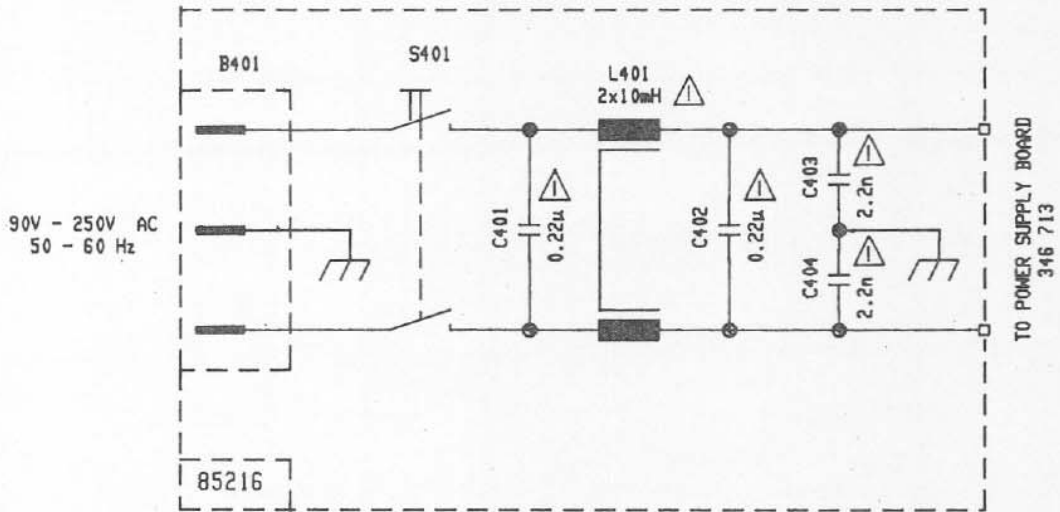
SAFETY COMPONENT
(MUST BE REPLACED BY ORIGINAL PART)

Pos. in diagram description	Part-No.	Pos. in diagram description	Part-No.
00010 plexiglas panel DLS 223	347875	D 111 diode 1N 4148	301254
00030 push button grey	344280	H 101 resistor netw RKL 9S 472J	336378
00040 push button black 12,5x7	337059	H 102 resistor netw RKL 9S 472J	336378
00050 push button black 6,4x 13,4	342496	L 101 coil	339139
00060 rotary knob black 16	342120	L 102 coil	339139
00070 rotary knob black 24	348055	L 103 coil	339139
00080 power supply	346713	L 104 coil	339139
		L 105 coil	339139
00010 PCB DLS 223	803848	L 106 coil	339139
C 175 safety component	343489	L 107 coil	339139
C 176 safety component	343489	L 108 coil	339139
C 177 safety component	343489	L 109 coil 47 UH	335966
C 178 safety component	343489	L 110 coil 47 UH	335966
D 101 diode 1N 4002	304360	L 111 coil 47 UH/5,5A	333717
D 102 diode 1N 4002	304360	L 112 coil	339139
U 118 IC MC 7805 C	309719	L 113 coil	339139
U 119 IC MC 79 L 05 ACP	309721	L 114 coil	339139
U 123 IC DLS 223 TMS 27C512-	346185	L 115 coil	339139
X 101 quarz 48.0000MHz	346787	L 116 coil	339139
X 102 quartz 4.0000MHZ	331341	L 117 coil	339139
00010 IC socket 28 pol	332354	Q 101 trans. BC 550 B	301184
		R 126 potentiometer 2x5kohm log	345484
00020 IC socket 28 pol	852328	R 127 potentiometer 2x5kohm log	345484
B 401 connector	338835	S 101 switch	344037
C 401 safety component 0,22MF	344934	S 102 sliding switch	338886
C 402 safety component 0,22MF	344934	U 101 IC RC 4558 P	304275
C 403 safety component 2.2NF	334682	U 102 IC NJM 4556 D	344864
C 404 safety component 2.2NF	334682	U 103 IC RC 4558 P	304275
L 401 coil 2x 10 MH	332961	U 104 IC RC 4558 P	304275
S 401 mains switch	331175	U 105 IC RC 4558 P	304275
		U 106 IC RC 4558 P	304275
00030 PCB DLS 223	862008	U 107 IC RC 4558 P	304275
B 101 phone jack	332352	U 108 IC RC 4558 P	304275
B 102 phone jack	332352	U 109 IC RC 4558 P	304275
B 103 phone jack	332352	U 110 IC RC 4558 P	304275
B 104 phone jack	332352	U 111 IC RC 4558 P	304275
B 105 phone jack	332352	U 112 IC LC 7520	346830
B 106 phone jack HLJ	332353	U 113 IC PC 900	333739
B 107 socket	303093	U 114 IC MC 74 HC 14	333458
B 108 socket	303093	U 115 IC MC 74 HC165 N	346829
B 109 socket	303093	U 116 IC MC 74 HC 74 N	339704
C 153 safety component	343489	00060 socket 6pol.	339842
C 172 KO-EL 220 MF 25V	343533		
D 101 diode 1N 4148	301254	00040 PCB DLS 223	871238
D 102 diode zener ZPD 10V	301309	D 201 display TDSR 1150 G	346828
D 103 diode 1N 4148	301254	D 202 display TDSR 1150 G	346828
D 104 diode 1N 4148	301254	D 203 LED red	345450
D 105 diode 1N 4148	301254	D 204 LED red	345450
D 106 diode 1N 4148	301254	D 205 LED red	345450
D 107 diode 1N 4148	301254	D 206 LED red	345450
D 108 diode 1N 4148	301254	D 207 LED red	345450
D 109 diode 1N 4148	301254	D 208 LED red	345450
D 110 diode 1N 4148	301254	D 209 LED red	345450

Pos. in diagram description	Part-No.	Pos. in diagram description	Part-No.
D 210 LED red	345450		
D 211 LED red	345450		
D 212 LED red	345450		
D 213 LED red	345450		
D 214 LED red	345450		
D 215 LED red	345450		
D 216 LED red	345450		
D 217 LED red	345450		
D 218 LED red	345450		
D 219 led green 3x5,5 mm	346753		
D 220 led green 3x5,5 mm	346753		
D 221 led green 3x5,5 mm	346753		
D 222 led green 3x5,5 mm	346753		
D 223 led green 3x5,5 mm	346753		
D 224 diode BAT 85	301297		
D 225 diode 1N 4148	301254		
D 226 led yellow 6x11 mm	346827		
D 227 LED green 6x11mm	331266		
D 228 led yellow 6x11 mm	346827		
D 229 LED green 6x11mm	331266		
H 201 resistor netw RKL 6S 103J	337954		
H 202 resistor netw RKL 6S 103J	337954		
H 203 resistor netw RKL 6S 103J	337954		
H 204 resistor netw RKL 6S 103J	337954		
Q 201 trans. BC 550 B	301184		
Q 202 trans. BC 550 B	301184		
Q 203 trans. BC 550 B	301184		
Q 204 trans. BC 550 B	301184		
Q 205 trans. BC 550 B	301184		
S 201 switch	339674		
S 202 switch	339674		
S 203 switch	339674		
S 204 switch	339674		
S 205 switch	339674		
S 206 switch	339674		
S 207 switch	339674		
S 208 switch	339674		
S 209 switch	339674		
S 210 switch	339674		
S 211 switch	339674		
S 212 switch	339674		
S 213 switch	339674		
S 214 switch	339674		
S 215 rotary encoder	346797		
U 201 IC MC 74 HC165 N	346829		
U 202 IC MC 74 HC165 N	346829		
U 203 IC RC 4558 P	304275		
U 204 IC RC 4558 P	304275		
U 205 IC MC 14411	333261		
U 206 IC UAA 2022 P	333487		
U 207 IC UAA 2022 P	333487		
U 208 IC UAA 2022 P	333487		

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Service and repair address for this product: Electro-Voice, Inc. 600 Cecil Street, Buchanan, Michigan 49107.

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