

**MSD200  
MSD200-SA**

**MASTER STEREO DISPLAY**

**USER'S MANUAL**

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# CONTENTS

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	Page
<b>1      INTRODUCTION</b>	<b>4</b>
Describes the Master Stereo Display and its concept.	
<b>2      ABOUT THE HARDWARE</b>	<b>8</b>
A closer look at some of the hardware components of the Master Stereo Display	
<b>3      INSTALLATION</b>	<b>11</b>
How to install the unit and make audio and power connections	
<b>4      OPERATION</b>	<b>13</b>
How to operate the Master Stereo Display, how to use it, and how to interpret the displayed data	
<b>5      SPECTRUM ANALYSER</b>	<b>25</b>
Describes the function of the FFT-spectrum analyser and how to use it	
<b>6      OUTPUT</b>	<b>32</b>
How to control the analogue outputs and set the tone generator	
<b>7      DEFAULT SETTINGS</b>	<b>34</b>
How to use the temporary and permanent default settings	
<b>8      SOFTWARE UPGRADE</b>	<b>36</b>
The procedure to download new software	
<b>9      CALIBRATION</b>	<b>38</b>
A brief note on calibration	
<b>10     TECHNICAL SPECIFICATIONS</b>	<b>39</b>
<b>11     APPENDICES</b>	<b>42</b>
<b>12     REGISTRATION</b>	<b>45</b>

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# 1 INTRODUCTION

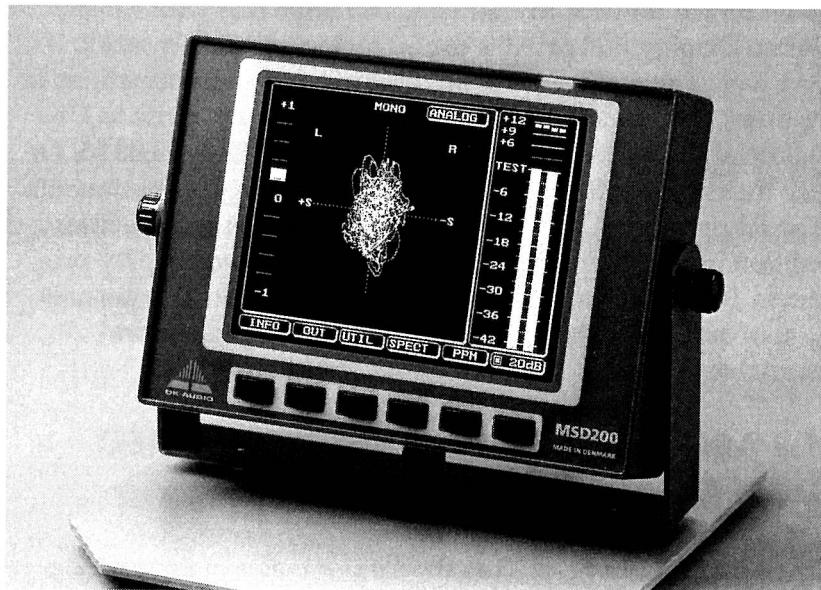
## 1.1 AUDIO METERING

In the audio industry one of the most important instruments used is the human ear. Producers, sound engineers and technicians rely on their hearing to create the sound they want, be it either the accurate reproduction of an acoustic instrument, or a new electronic musical. Many people from different walks of the audio industry have truly "Golden Ears", that will tell them all they need to know about the sound, and while the human ear is a highly sophisticated instrument not to be outdone by man, it is very subjective and as such may well be misleading as to what is expected of the final product. And, of course, if you do not believe in "Golden Ears", you may want help from other sources.

As the eyes account for as much as 4/7 of all the human senses, it is an obvious strength to be able to see what you hear, and it is certainly a great way to confirm the opinions formed by your hearing.

By being able to visualize the audio signal with the assistance of various metering options, things that before were extremely difficult to hear (read: impossible) now become obvious to the eye. The primary tools for this purpose are: The Correlation Meter, The Audio Vector Oscilloscope, and The Level Meter.

Until very recently, level metering, phase indication and stereo image monitoring have been left to traditional instruments such as bar graphs, LED's, and oscilloscopes. Enter the Master Stereo Displays from DK-Audio combining all these functions and more in one compact audio monitoring workstation.



The family of Master Stereo Displays now ranging from low-cost monochrome versions to multichannel colour versions all share the same basic functions: The Correlation Meter displaying the average relationship between two audio signals, The Level Meter indicating the level of the signal on up to as many as 7 international scales with peak and overload indication, and The Audio Vector Oscilloscope producing a visual picture of the audio signal and thus making it easy to recognize mono or stereo patterns.

Add to this options such as Spectrum Analysers, Level Recording, and Acoustical and Vibration Analysers, and you have a complete metering system available.

By purchasing a Master Stereo Display from DK-Audio you have decided to actually "see what you hear!". We wish you a

good return on your investment, and hope that your Master Stereo Display will prove a useful tool in your daily work. If you have any comments or suggestions for future functions or options, we would like to hear from you. Please write to DK-Audio at the address on front page, or call +45 44 53 02 55. Or use the enclosed Registration Card to send us your comments. The Registration Card is also your easy way to receive information from DK-Audio on future Master Stereo Display products. Returning your registration to DK-Audio also ensures you of quick information on new software up-dates and available options.

## **1.2 ABOUT THE MSD200 MASTER STEREO DISPLAY**

The MSD200 can be used as the master meter of any mixing console or other studio and broadcast applications. It displays the stereo information and the stereo programme level at the same time, and provides the engineer with the maximum information about the recorded or transmitted audio signal.

The characteristic of the PPM can be selected from softkeys, and most international standards are supported. The input reference level is individually selectable, together with an additional 20 dB of input gain (in analogue mode only). All processing is digital and ballistic, and scale errors are virtually eliminated.

A non-volatile memory chip will store all user defined parameters.

The new electroluminescent display has a very high contrast ratio and a 160° viewing angle, and the life-time of the screen averages more than 20 years of normal use (70.000 hours).

The mounting bracket and the supplied base plate make it easy to fix the unit to the console or desk, and allows the unit to be adjusted to obtain best viewing angle.

## **1.3 PRECAUTIONS**

**Important: Before removal of the housing disconnect the power supply. Never apply power while the housing is removed.**

Please observe the following guidelines for a longer, trouble-free life of your MSD200:

- never operate the unit while opened, as high voltage (600 V AC) applied to the EL-display is dangerous.
- avoid getting the unit wet or humid, since water will create leakage currents on the PCB board and may damage the circuitry.
- the protective glass in front of the display is susceptible to scratches. Handle very carefully, and clean with normal household window polisher.

## **2 HARDWARE**

In this section we take a closer look at the components of the MSD200 Master Stereo Display.

### **2.1 THE AUDIO INPUTS**

The MSD200 is equipped with both analogue and digital inputs. All connections are made via a standard 25-pole DSUB connector on the rear of the cabinet. The sensitivity is 1,55V.

The analogue input section have dual transformer-coupled inputs, which work independently. Due to this special design there is no return influence on the feeding audio lines, and the input impedance will remain constant without power. The performance of the analogue stages is so excellent that the unit can be used for testing external circuits.

### **2.2 THE AUDIO OUTPUTS**

The unit has two electronically balanced outputs, and carry the same signal on both outputs except in the input monitoring mode. The output drive level is HIGH. The output connections are also via the 25-pole DSUB on the back of the unit.

See Appendix A for connection specifications and pin configuration.

### **2.3 THE COMMUNICATION PORT**

The MSD200 has a serial RS232 communication port integrated in the 25-pole DSUB socket.

## **2.4 THE POWER SUPPLY**

The power supply is based on the linear regulation and switch mode principles and accepts DC input in the range 12-15 V. The power input is via the 25-pole DSUB.

**Recommended supply voltage is 12V DC.**

A 230V Power Supply Adapter is supplied with the MSD200 as a standard accessory (Europe only).

**NOTE: Special care must be taken in a service or maintenance situation as 600 V AC is present on the top PCB.**

## **2.5 THE CODEC CIRCUIT**

The Codec circuit integrates the key audio data conversion and control functions into a single integrated circuit. Anti-alias and anti-imaging filters are incorporated on-chip. Dynamic range and signal-to-noise will typically exceed 80 dB over the 20 kHz audio band. Sample rate is fixed at 48 kHz.

The Codec includes a pair of  $\Sigma$  analogue-to-digital converters (ADC's), and a pair of  $\Sigma$  digital-to-analogue converters (DAC's). Gain can be controlled independantly for each channel.

The  $\Sigma$  DAC's are preceded by a digital attenuator and a digital interpolation filter. Nyquist images are removed from the DAC's analogue stereo pairs by on-chip switched-capacitor and continuos-time filters.

## **2.6 THE DECODER**

The digital section of the MSD200 is equipped with a Crystal® CS4812 decoder, which detects the sampling frequency, and determines whether the signal is of AES/EBU or SP/DIF type. It is thus possible to use signal sources of both types. The sampling frequencies are 44,2 kHz and 48 kHz.

## **2.7 THE DSP MICROCOMPUTER**

The Analog Devices® ADSP-2181 is a single chip microcomputer optimized for digital signal processing (DSP) and other high speed numeric processing applications. The computer has 16K words of (16-bit) data memory RAM, and 16K words (24-bit) program memory RAM on-chip. It runs with an instruction cycle of 30 ns from 16.67 MHz crystal @ 5.0 Volts.

## **2.8 THE FLASH-PROM (PROGRAM STORAGE MEDIA)**

All software is stored in the FLASH-PROM circuit. The FLASH-PROM circuit is only active during program loading, all real-time computation takes place internally in the DSP.

The FLASH-PROM configuration allows new software to be downloaded by the RS232 serial communication port.

## **2.9 THE ELECTROLUMINESCENT DISPLAY**

The EL-display has a graphic resolution of 320 dots (horizontal) by 240 dots (vertical). The display is controlled directly from the DSP.

The display is very fast, and has an extremely high (1:50) contrast ratio and a 160° viewing angle, allowing readings to be taken from far away and at extreme right and left angles.

# **3 INSTALLATION**

## **3.1 MOUNTING**

The MSD200 is supplied complete with mounting bracket and fittings, making it easy to mount on any console or desk. The bracket makes it possible to adjust the unit both horizontally and vertically for the best viewing position.

The enclosed fittings for mounting are:

- 1 bracket (U-form)
- 1 circular base plate
- 3 finger screws w/washers

Mounting screws are not supplied.

To mount the MSD200 in as flexible manner as possible use the supplied base plate. Screw the base plate to your console or work surface using 2 pcs. 4 mm wood screws (or appropriate alternative depending on material). Fix the bracket on top of the base plate and secure with a finger screw. Now fix the MSD200 to the bracket by two finger screws. Insert spring-washers between bracket and cabinet/base plate, and insert star-washers between bracket and fingers screws to ensure a firm grip.

This will allow the MSD200 to be turned both horizontally and vertically thus allowing for best viewing angle.

If you want a firm mount only allowing the unit to be turned horizontally, screw the bracket directly to your console or work surface using 2 pcs. 4 mm screws.

A standard base-plate to mount the MSD200 is available as an optional extra. This is made of 4 mm aluminum with four rubber feet to ensure a solid grip on the work desk. Order number: MSD-BASE/O.

## **3.2 AUDIO CONNECTIONS**

The MSD200 is connected to your audio source via the standard 25-pole DSUB socket on the rear of the unit. The selection of analogue or digital audio input mode is made via the soft-keys. See specifications and pin configuration in Appendix A. Use standard or multipair audio signal cable, and make sure that the connections are firmly secured. Allow enough loose cable for the unit to be tilted and turned. A 25-pole DSUB connector is enclosed with the unit.

## **3.3 POWER CONNECTION**

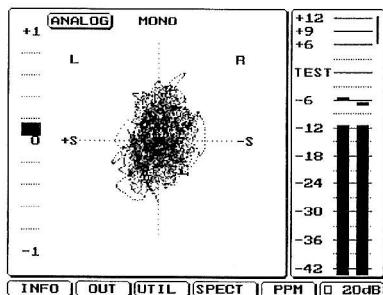
The recommended supply voltage is 12V DC. The actual operating voltage range is 12-15 V DC. Power is connected to the unit via the standard 25-pole DSUB socket on the rear of the unit. Feed it either from the standard power adapter supplied with the unit or from an appropriate power source in your console or desk. Make sure that the connection is secure and allow enough loose cable for the unit to be tilted and turned.

A standard 230V/50Hz power adapter is supplied with the unit (Europe only).

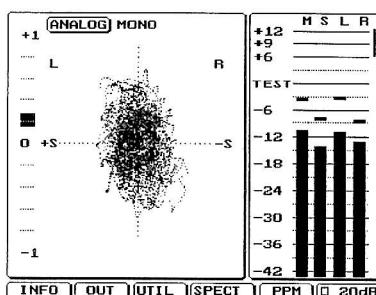
# 4 OPERATION

## 4.1 THE MAIN DISPLAY AND CONTROL KEYS

The main display shows all three types of information simultaneously: The Phase Meter (left), The Audio Vector Oscilloscope (center) and The Level Meter (PPM) (right). Below these main displays are displayed the menu text line for softkeys and additional information for the selected function. In the upper left and right hand corners of the oscilloscope area of the display, there are two indicators for ANALOGUE/DIGITAL mode and overload COUNTER (when selected).



MAIN DISPLAY  
2-CHANNEL



MAIN DISPLAY  
4-CHANNEL

The INFO-menu display (see page 34) will indicate the software version installed, for instance MSD200 1.33.

The 6 keys under the display are assigned to the functions displayed in the menu text line. The functions of the keys change as menu points are selected. The black square in some of the function keys indicate ON when the key is pressed. To return to the previous menu select [EXIT].

### **4.1.1 INPUT SELECTION [UTIL]**

To select between analogue or digital inputs press [**UTIL**] in the MAIN menu, and select either digital [**DIG**] or analogue [**ANA**].

## **4.2 THE PHASE CORRELATION METER**

The phase correlation meter is of the so-called “Center-Zero” type, and displays the phase relationship between the two input signals. A stereo signal will ideally show [0] which is random distributed phase, and therefore the maximum ambient effect. Mono will indicate [+1], and a signal with reversed phase components will indicate in the range [0] to [-1].

**Never allow negative indication if your signal is going to be reproduced in mono.**

Input signals below a predefined threshold will force the indication towards zero. Only major phase components are considered.

The phase meter can operate in FAST or SLOW mode. In the MAIN menu select first [**UTIL**] then [**CORR**] and toggle between SLOW and FAST modes by pressing the [**SLOW**] and [**FAST**] keys.

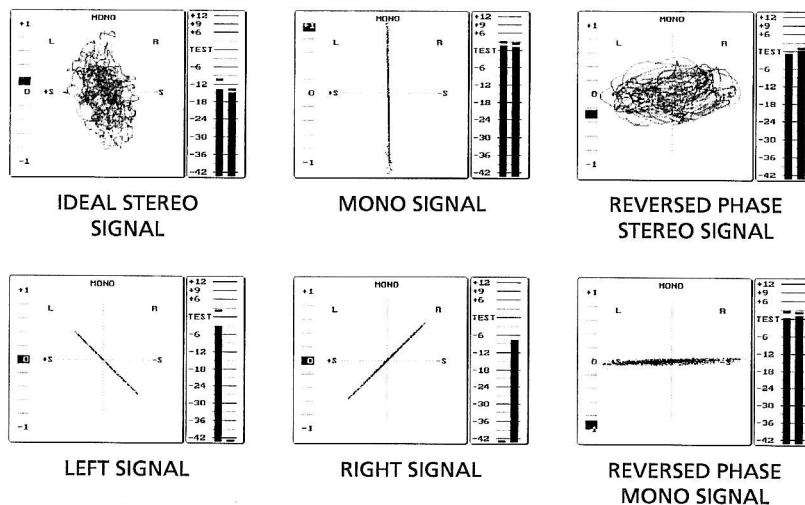
## **4.3 THE AUDIO VECTOR OSCILLOSCOPE (Stereo Image Monitor)**

The audio vector oscilloscope is also known under the names of Stereo Image Monitor and Goniometer. It is based on continuous graphic illustration of the phase and amplitude of the stereo signal in the Lissajous-format.

If phase and amplitude are randomly distributed, the signal is an ideal stereo signal.

Normally this will only happen with a live recorded signal. Applause from a live recorded audience gives you an excellent example of a true stereo signal. The figure of a true stereo signal should be represented on the oscilloscope as a perfect circle, or rather as a "ball".

See the illustrations below for examples of different types of signals as they appear on the display, and note also the relationship between the representations on the correlation meter and the oscilloscope.



## 4.4 THE PEAK PROGRAMME METER (PPM)

The peak programme meter is designed for direct measurement of the quasi-peak level of complex electrical signals occurring in the transmission of music and speech, without varying the sensitivity of the device, to achieve optimum technical utilization of the transmission channel, or of the recording medium.

For this purpose a full-wave rectifier is used, and the integration time is chosen to obtain an amplitude as high as possible, without overloading the transmission link for a period long enough to give rise to audible non-linear distortion of the programme. The return time is relatively long in order to avoid unnecessary viewer fatigue.

The MSD200 features 4 different international PPM scales in accordance with IEC 268-10, IEC 268-17 and DIN 45406, as well as a standard VU and a 2 digital scales. The available scales are:

- |   |           |                            |
|---|-----------|----------------------------|
| 1 | Type I    | Nordic                     |
| 2 | Type IIA  | BBC                        |
| 3 | Type IIB  | EBU                        |
| 4 | Type DIN  |                            |
| 5 | Type VU   |                            |
| 6 | Type DMU1 | Digital 1 (0 to -60 dB)    |
| 7 | Type DMU2 | Digital 2 (0.0 to -6.0 dB) |

Scales nos. 6 and 7 are similar to the digital SONY scales as in for instance the SONY DMU-30. Scale no. 7 is especially well suited for mastering because of its high resolution at test level.

The different scales are selected from the [**PPM**] menu. Select [**SCALE**] and then toggle between the scales by pressing the appropriate key. The [**MORE**] key accesses the last 3 scales.

Please refer to the drawing of the scales in section 4.8.1, page 18. The level meter of the MSD200 features the following additional functions:

- "Flying" Peak Indication
- Peak Hold

- Overload Indication
- Overload counter (OVR)
- Individual reference level selection
- Selectable Stereo or Stereo-MS operation

#### **4.4.1 STEREO-MS (4-CHANNEL) OPERATION**

The MSD200 is factory set with Stereo-MS PPM configuration, meaning that it will show the stereo signal in 4-channel mode as follows: M (mono), S (stereo), L (left), R (right).

This feature allows you to control the mono signal by showing the sum signal (M) of L and R inputs, as well as the stereo width by showing the difference signal (S). The sum and difference signals has been reduced by 3 dB in agreement with general practice.

The normal 2-channel stereo PPM can be implemented by downloading the software from the accompanying floppy disk.

#### **4.5 INPUT GAIN**

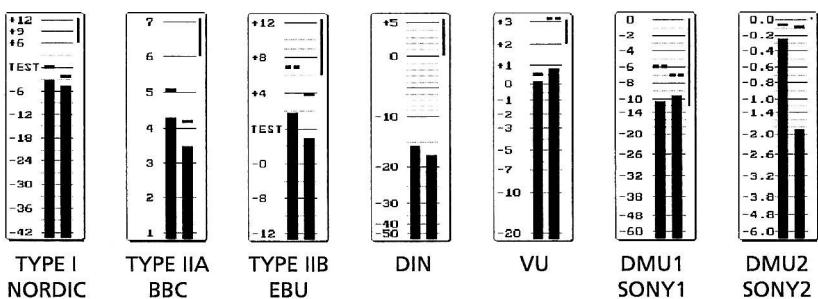
The input sensitivity can be increased by 20 dB by pressing the **[20 dB]** key in the main menu. The function is used to obtain the best possible dynamic range and accuracy of a weak signal. The 20dB gain function is working only in analogue mode, and is disabled during digital operation.

#### **4.6 OPERATING THE PPM FUNCTION**

Enter the PPM menu by pressing the **[PPM]** key. From the PPM menu you can choose one of the 7 international scales defined in the unit by pressing **[SCALE]** as well as selecting the options "Flying" **[PEAK]**, **[FAST]**, **[HOLD]**, and **[OVR]**.

## 4.6.1 SELECT PREFERRED PPM SCALE

7 international scales are supported as described in paragraph 4.4. Please study the following reference reports to obtain the complete set of specifications: the IEC268-10 Peak Programme Level Meters, the DIN 45406 and the Pflichtenhefte 3/6, the IEC 68-17 VU Meter, the Nordic N9, the CCIT Report 292-2 and BS6840 part 10.



To select the preferred scale first enter the [**SCALE**] menu point. Then select the required scale by pressing the appropriate key.

## 4.6.2 SETTING THE PPM REFERENCE LEVEL (GAIN dB)

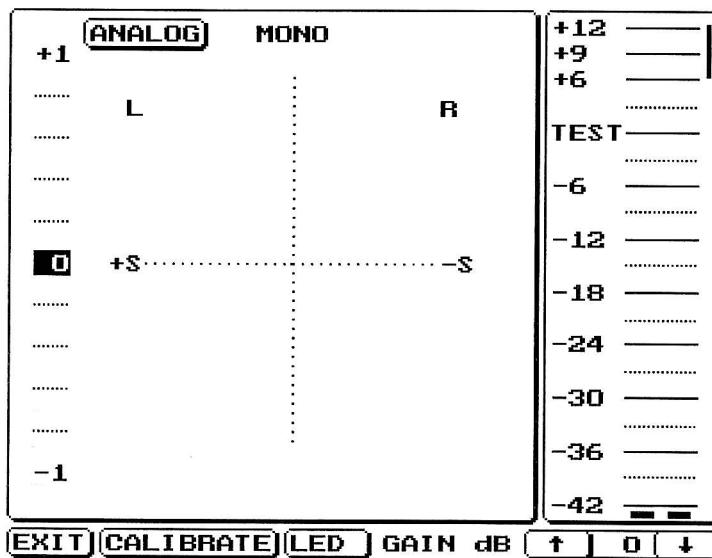
The PPM reference levels (gain in dB) may be set individually for each scale. To do so first take off the write protection: go to the INFO-menu, and select [**WR-PROTECT**] OFF. Then [**EXIT**] to MAIN menu and select [**PPM**] and then [**SCALE**]. Now select the scale you which to set the reference level for, and a menu point GAIN dB will appear. By stepping the arrow keys [**UP**] or [**DOWN**] you set the reference level for the selected scale. After setting the reference level EXIT to SCALE menu. Repeat the procedure for each of the scales.

The reference level may be set individually for each scale for

both analogue and digital mode. In other words, there are two reference levels available for each scale.

**Note:** Any changes made with the write protection OFF will change the reference point of the PPM. After setting the reference level as described above, do not forget to step back to the INFO-menu to put the WR-PROTECT back on. See paragraph 7.0 for instructions on how to make permanent settings.

**Note:** Test level 0 dBu (0.775V RMS) is standard.

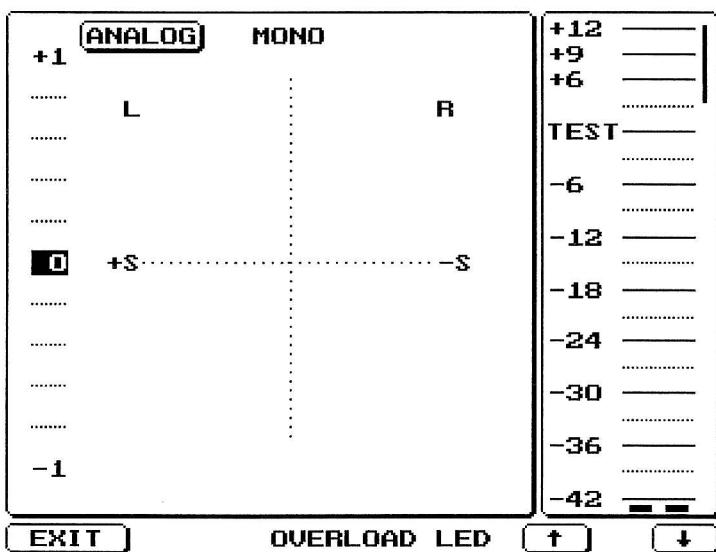


#### 4.6.3 LED OVERLOAD LEVEL

The LED overload level, i.e. the level where the LED's above the left and right PPM bars lights up, may be set individually for each scale. The PPM bar in the overload sector will change its appearance to a split bar to further identify the overload level.

To set the overload level go to the INFO menu and select [WR-PROTECT] OFF. Then EXIT to MAIN menu and select first [PPM] then [SCALE]. Now choose the appropriate scale and select [LED]. Step the overload level up or down by the arrow [UP] and [DOWN] keys. The selected level will be indicated by a vertical line to the right of the PPM bars. The bottom of the line will be the set overload level, and the line itself will represent the signal overload area.

The LED overload setting is universal for both analogue and digital modes, i.e. only one setting per scale.



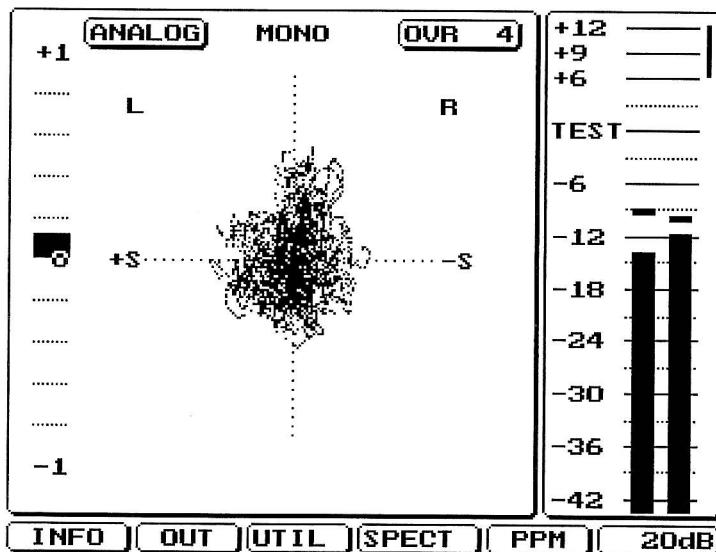
#### 4.6.4 PPM PEAK HOLD

The Peak HOLD function will allow you to check the maximum signal level during, or especially after, the recording session. Thus you can ascertain that the level does not exceed any predetermined limits.

To select Peak HOLD from the MAIN menu press first the [PPM] key, then toggle the HOLD function on or off by pressing the [HOLD] key.

In the HOLD mode, the "flying" segments on the PPM bars will indicate the highest bar-graph value since the last hold reset. The HOLD function is only available when PEAK is selected.

- If an overload occurs while HOLD is active the LED indicator of the corresponding channel will remain lit until next RESET.



#### 4.6.5 OVERLOAD COUNTER (OVR)

The MSD200 will count the number of LED overloads during operation. To select this function from the MAIN menu, select

**[PPM]** then toggle the **[OVR]** key ON or OFF. The counter appears in the upper right hand corner of the oscilloscope display when selected, and has a maximum count of 99.

## 4.6.6 PPM FAST MODE

To select FAST mode press first the **[PPM]** key, then **[FAST]**. Then toggle the FAST function on/off by pressing the **[FAST]** key.

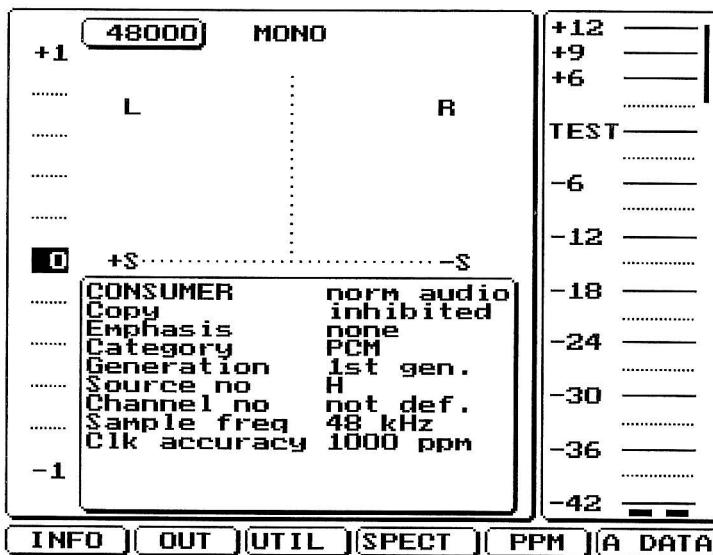
In the FAST mode the PPM integration time is set to zero. The bar-graph therefore indicates the peak value of the input signal. Please note: with a steady sinusoidal signal the bar-graph indication is the same whether FAST is enabled or not.

## 4.7 DIGITAL MODE

When DIGITAL mode is selected a new menu point **[DATA]** appears, and the sampling frequency will be calculated and shown in the upper left hand corner of the oscilloscope display area.

### 4.7.1 BITSTREAM STATUS DISPLAY

In digital mode you have the possibility of displaying the bit-stream data information for each of the four channels on the main display. This will allow you to determine for example the following:



## PROFESSIONAL/CONSUMER

This indicates whether the signal originated from professional or consumer type equipment, and thus indicates the necessary decoding mode.

**EMPHASIS**

**SAMPLE FREQ.**

**CHANNEL MODE**

**USER BIT**

**WORD LENGTH**

**REF.SIGNAL**

**ORIGIN**

**DESTINATION**

In addition to this the unit can show hours, minutes, seconds as well as a frame counter in the following format:

## **H:M:S:FRAM 00:00:00:000**

For further information on the status display please refer to IEC928.

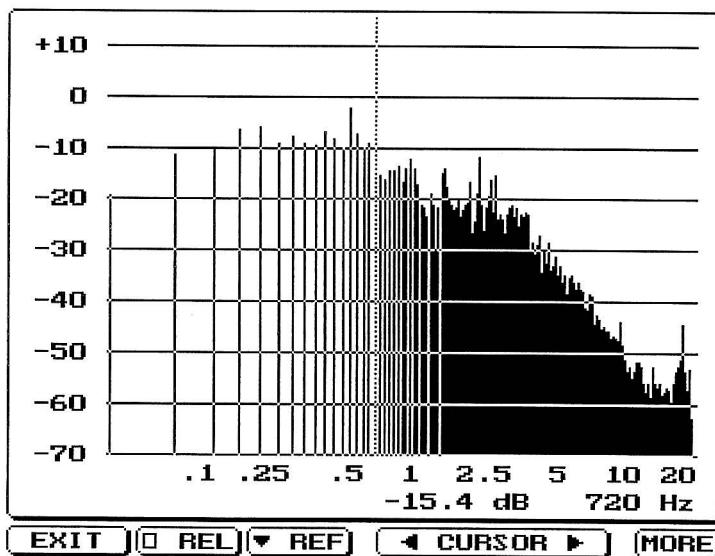
The above information may be displayed for each of the two channels when digital mode is selected. To display channel 1 select **[INPUT]** on the main menu, then **[CH DATA]**. Then select the appropriate channel, for example **[A DATA]** for displaying the information for channel 1. Toggle the DATA key between channel 1, channel 2, and main display.

Displaying of the bitstream data is conditional to the source equipment actually transmitting these data. If there is no signal (the sampling frequency indicator shows OPEN) the bit-stream status display will not be shown.

# 5 SPECTRUM ANALYSER (MSD200-SA)

## 5.1 FFT-SPECTRUM ANALYSIS

Most spectrum analysers for sound engineering are based on analogue filtering techniques. For many years this has been the only practical solution for real-time analysers at a sensible size and cost. Modern signal processors like the MSD200-SA has made it possible to implement the complex FFT (Fast Fourier Transformation) algorithm, which outperforms its analogue counterpart by many lengths. The number of frequency bands are increased from the traditional 27 or 31 to 1024, and the dynamic range to 80 dB. The improvements make it possible to analyse noise, distortion (IM) and frequency response in a much more detailed way.



## 5.2 SPECTRUM ANALYSER OPERATION

To enter the FFT Spectrum Analyser mode select the **[SPECT]** key. This opens the FFT screen on the display, with frequency indicators from 44 Hz to 20 000 Hz at the bottom, and level indicators on the left hand side. The level is indicated in 10 dB intervals from +10 to -70 dB.

To obtain more accurate readings at the bottom frequencies the MSD200 has a ZOOM function which changes the displayed frequency range to 4,4 Hz to 2 000 Hz. In the SPECT menu select **[MORE]** then toggle the ZOOM function on/off by pressing the **[ZOOM]** key.

Note that the low frequency screen display operates slower by a factor 10.

## 5.3 SELECTING INPUT SIGNAL

In the SPECT menu select **[MORE]** then **[INPUT]**. The INPUT menu allows you to select input as follows: MONO (left + right), STEREO (left - right), LEFT and RIGHT. You can also select OUTPUT **[OUT]** to loop the outputs back into the FFT-spectrum analyser.

## 5.4 FREQUENCY CURSOR MOVE

The arrow keys in the SPECT menu will move the frequency cursor left or right. While holding the key down the speed of the cursor movement is increased by a factor of ten. Exact placement of the cursor is done with individual key strokes. The numeric field shows the level and frequency of the cursor position.

The resolution of the spectrum analyser is higher than the screen resolution. Consequently not all analysis results are

displayed. The frequency cursor can be used to obtain the 'hidden' data since it will display the complete set of data.

## **5.5 FREQUENCY CURSOR RELATIVE SET [REF]**

This function works together with the Display Relative Set function (5.6). With the **[REF]** key the curve readings can be normalized to the reading at cursor. If the display relative set is active the complete curve is shifted up or down until the cursor reading is zero. The **[REF]** key will only manipulate the on-screen data and should generally not be used to raise a weak signal since accuracy is lost.

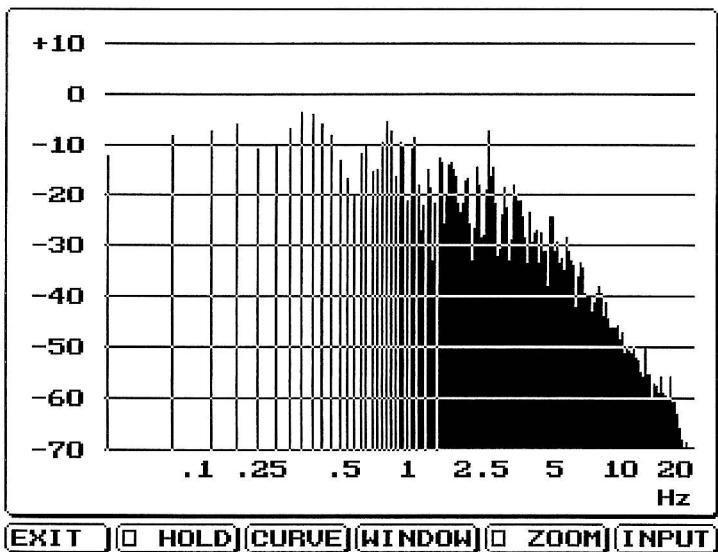
The numeric readout will always follow the graph.

## **5.6 FREQUENCY CURSOR RELATIVE DISPLAY [REL]**

The display relative function is used in conjunction with the set relative function (5.5). The **[REL]** function key will toggle between an absolute and a relative readout for both the graph and the numeric readout.

## 5.7 SPECTRUM ANALYSER MENU LEVEL TWO [MORE]

Menu level two provides more data manipulation functions. At this menu level the frequency cursor is not displayed. Select [MORE] to access the level two menu.



### 5.7.1 HOLD FUNCTION

The HOLD function will disable the display fall back function and thus show the maximum value since the HOLD was activated.

### 5.7.2 CURVE MENU

The curve menu is used to display the spectrum analysis relative to a temporary or predefined reference curve. The relative display functions can all be active at the same time.

### **5.7.2.1 TEMPORARY CURVE STORAGE [REF]**

This function is used to store a curve temporarily in order to show the difference curve with the display relative function (5.7.2.3).

Press **[REF]** and the curve currently on screen will be memorized. The memorized curve is reset to 'flat' response everytime the spectrum analyser is terminated.

This function is useful for acoustic testing of rooms, loudspeakers etc.

### **5.7.2.2 PERMANENT CURVE STORAGE [MEM]**

This function is used to store a curve permanently in the FLASH-PROM in order to show the difference curve with the display relative function (5.7.2.4). The curve currently on screen will be memorized by pressing the **[MEM]** key, and will be recalled when ever the spectrum analyser is engaged.

The memory function is sensitive to the write-protection **[WR-PROTECT]**. If write-protection is on the **[MEM]** can be used for temporary storage only.

This function is useful for acoustic testing of rooms, loudspeakers etc.

### **5.7.2.3 RELATIVE DISPLAY TEMPORARY CURVE [+REF]**

Select the **[+REF]** function to add the temporary curve storage (5.7.2.1) to the current audio spectrum.

#### **5.7.2.4 RELATIVE DISPLAY PERMANENT CURVE [+MEM]**

Select the **[+MEM]** function to add the permanent curve storage (5.7.2.2) to the current audio spectrum.

#### **5.7.2.5 RELATIVE DISPLAY PRE-EMPHASIS CURVE [+PRE]**

The pre-emphasis is 'lifting' the data readout with 3 dB/octave, resulting in a visual appearance of a 1/3 octave analyser.

This lift provides a closer relationship between the aural and the visual judgement of the musical audio spectrum.

### **5.7.3 WINDOW MENU**

Since the spectrum analyser is based on the Fast Fourier Transformation principle the sampled audio data need *windowing*. An in depth mathematical explanation is not the scope for this manual and should be retrieved from other technical literature.

The audio is sampled with 48kHz and entered in a digital buffer having the length of 1024 entries. This amount of audio samples is then analysed and displayed. While calculating the FFT a new set of data is recorded. No data is lost.

Since the 1024 samples used for the calculations is a window of the continuous audio samples the beginning and the end of the 1024 need some smoothing in order not to develop erroneous results. The data needs *windowing*.

The system is implemented with several different window functions. The recommended window function for most applications is the HANNING window (5.7.3.2).

### **5.7.3.1 RECTANGULAR WINDOW [REC]**

In the rectangular window function all samples are multiplied with one. This window function is merely a method of disabling windowing of the data.

**The rectangular window provides the highest selectivity, but the lowest dynamic range.**

### **5.7.3.2 HANNING WINDOW [HAN]**

The Hanning window is useful in most applications and should be selected as default.

**The HANNING window provides high dynamic range, but low selectivity.**

### **5.7.3.3 HAMMING WINDOW [HAM]**

The Hamming window is ideal for applications where the requirement for the dynamic range is known.

**The HAMMING window compromises between selectivity and dynamic range.**

### **5.7.3.4 NUTTALL WINDOW [NUT]**

The Nuttall window is especially useful for distortion measurements.

**The Nuttall window provides the highest dynamic range and compromises the selectivity.**

# **6 OUTPUT MENU [OUT]**

From the output menu the stereo analogue outputs are controlled.

## **6.1 SELECT TONE SIGNAL [TONE SET]**

This function will enable or disable the low distortion tone generator.

### **6.1.1 TONE GENERATOR SETTINGS [SET]**

The tone generator is driving both outputs with the same signal, but each output driver is separate. To enter the SET menu press **[SET]**.

#### **6.1.1.1 TONE GENERATOR FREQUENCY**

With the arrow left and right keys the output frequency is set. The frequency can be chosen in large steps, by activating the **[x10]** key, or in smaller steps without this key.

#### **6.1.1.2 OUTPUT AMPLITUDE SETTING**

With the arrow up and down keys the output amplitude for tone generator is set in dBu. The output amplitude can be set in large or small steps by use of the **[x10]** key.

## **6.2 SELECT INPUT SIGNAL**

If input **[INP]** is selected, the input signal will be 'echoed' to the output. This function is used to monitor the audio signal to the MSD200, and is not intended as an actual 'loop-through' function. This function operates with both analogue and digital input signals.

## **6.3 SELECT TEST OUTPUTS [WAVES]**

From this menu point you can select five different types of test signals:

White Noise [**WHITE**]

Pink Noise [**PINK**]

Cross Modulation test signal [**XMOD**]

Total Harmonic Distortion test signal [**THD**]

Impulse [**IMP**]

Note that the white and pink noise generated by the MSD200 is pseudo-white and pink noise. It will not sound like the noise you are used to hear, but will otherwise perform to specifications.

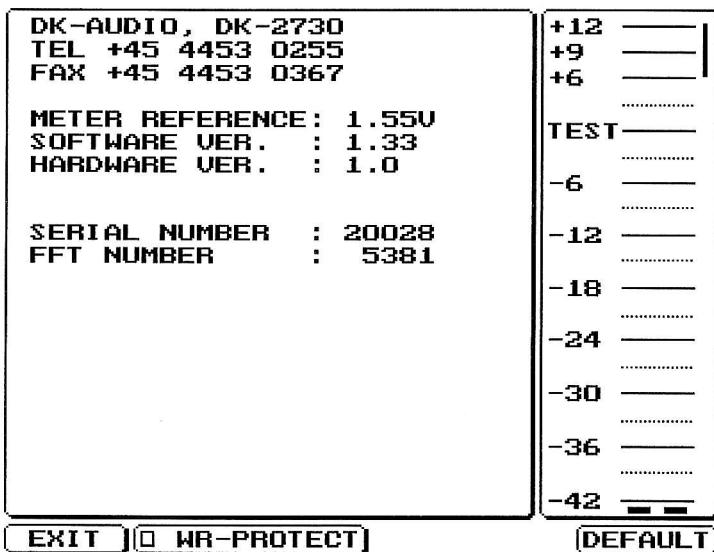
# 7 DEFAULT SETTINGS

The MSD200 default settings work in two levels. One temporary while the unit is in operation; and one permanent which will be the actual setting when the unit is powered up.

## 7.1 TEMPORARY DEFAULT SETTINGS

[WR-PROTECT]

Selecting any default setting by using the write protection off function **[WR-PROTECT]** from the INFO menu, is valid for temporary default settings while the unit is operating, but will be overridden by the next power up.



## **7.2 PERMANENT DEFAULT SETTINGS [WR-PROTECT] + [DEFAULT]**

To set the MSD200 to always power-up with user selected default settings, as for instance PPM scales, reference levels etc., proceed as follows:

Set PPM scale and individual reference level:

1. Select **[WR-PROTECT]** off
2. Select preferred PPM scale as per para. 4.6
3. Exit to INFO menu and press the **[DEFAULT]** key
4. Put the **[WR-PROTECT]** on

### **7.2.1 PERMANENT DEFAULT SETTINGS**

The following parameters can be set to permanent default:

1. PPM Scales, analogue and digital
2. PPM Scale reference level, analogue and digital
3. Input selection, analogue or digital
4. Windowing function (FFT-spectrum analyser)
5. Tone generator settings

## **8 SOFTWARE UPGRADE**

To up-grade the MSD200 to newer software versions or to add new options, connect the RS232 port of the MSD200 to a PC via the COM1 or COM2 port.

The new software will be supplied on floppy-disk or may be retrieved from the Internet.

**☞ Please note that the unit must be in ANALOGUE input mode while down-loading software.**

### **8.1 COM PORT SELECTION**

A COM port must be selected on your PC. If you use COM1, type 'SET MSD-LOAD=1' at the DOS-PROMPT. If you use COM2, type 'SET MSD-LOAD=2'.

If a COM port has not been set, the up-date program will prompt you for this.

### **8.2 UP-DATE PROCEDURE**

While in DOS-PROMPT in the correct library for MSD200 update software (for example A:\ if you have chosen to run the up-date from the floppy-disk) type 'update' and [ENTER]. This will download the new software from the PC to the MSD200.

Following this you must re-power the MSD200 to implement the new software. The new software version number will be shown in the INFO menu.

Make sure that you do not strike any key on the MSD200 while the PC is downloading software. Usually pauses will occur

during the downloading procedure. At such pauses the PC will prompt you to press any key to continue, but before doing so make sure that MSD200 is still in analogue mode.

## **9 CALIBRATION**

The MSD200 is factory calibrated. In normal use it should not be necessary to re-calibrate the unit at all. Unless you are very familiar with this type of product/procedure, we recommend that you do not attempt to calibrate your MSD200.

The **[CALIBRATE]** menu point in the PPM menu is for service use only. Do not adjust these settings without the complete calibration procedure available from DK-Audio.

# 10 TECHNICAL SPECIFICATIONS

## 10.1 POWER SUPPLY

Supply voltage range:	12-15 V DC
DC Current consumption @ 12 V nominal supply:	approx. 8 Watt
Safety according to:	IEC 65

A 230V/50 Hz AC power supply adapter with a 12V DC output is supplied as standard with MSD200 (Europe only).

## 10.2 CABINET DIMENSIONS

Width:	179 mm
Height w/o bracket:	129 mm
Depth:	39 mm

## 10.3 LEVEL METER

Reference indication:	0 dBm
Reference input voltage:	1.55 V
Ref. input voltage adj.:	+14 dB to -2 dB
Division of scales:	
Type I	-42 dB to +12 dB
Type IIA:	1 to 7
Type IIB:	-12 dB to +12 dB
Type DIN:	-50 dB to +5 dB
Type VU:	-20 dB to +3 dB
Type DMU1:	-60 dB to 0 dB
Type DMU2:	-6.0 dB to 0.0 dB
Amplitude frequency response 30 Hz to 20 kHz:	+/-0,3 dB

Dynamic response:	
a)Pflichtenheft 3/6:	3 ms / -3 dB
b)IEC 268-10	5 ms / -2 dB
c)IEC-268-17	VU:300 ms
Overswing:	none
Return time:	
a)Pflichtenheft 3/6	20 dB/ 1.5 s
b)IEC 268-10	20 dB/ 2.0 s
Reversibility error:	none
Input impedance:	>20 kOhm
Distortion introduced by the PPM:	none
Temperature range:	0° C to 45° C
Overload characteristics:	>21 dBu
Max. input level:	90 V RMS cont.

## 10.4 PHASE CORELLATION METER

Indication range: -1 to +1

## 10.5 AUDIO VECTOR OSCILLOSCOPE

Automatic gain adj. range:	30 dB, default
Phase error between channels:	none
Display area:	69 x 69 mm

## 10.6 ELECTROLUMINESCENT DISPLAY

Resolution:	320 x 240 dots
Pixel size:	0,26 mm
Lifetime:	70.000 hours
Contrast ratio:	1:50
Viewing area:	120 x 92 mm
Viewing angle:	> 160°

## **10.7 TONE GENERATOR OUTPUT**

Frequency range: 31 Hz to 15500 Hz

Level range: -2 – +18 dBu

Distortion @ 15 dBu: -70 dB

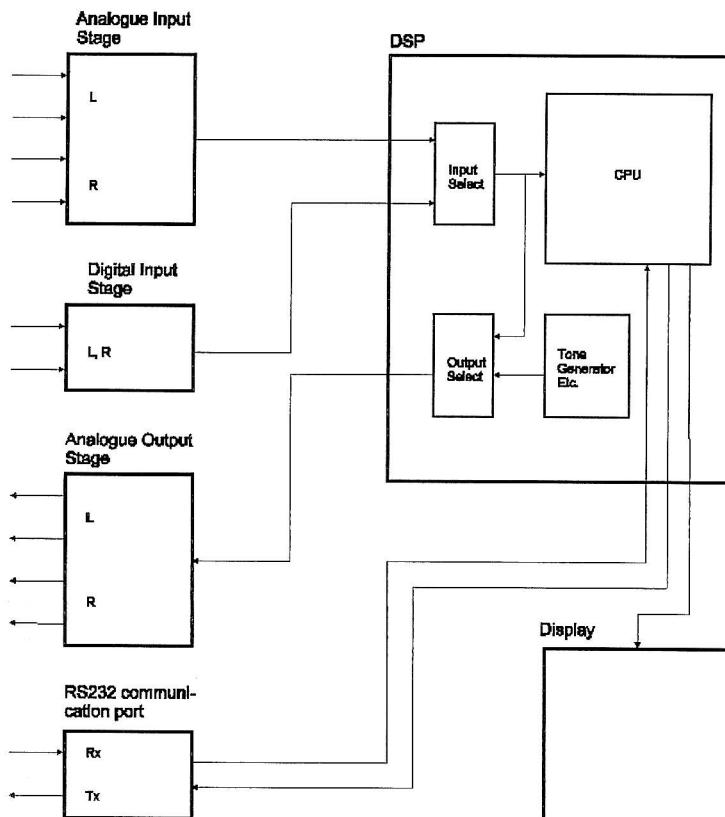
# APPENDIX A

## Master Stereo Display MSD200/MSD200SA 25-pole DSUB Connector Pin Configuration Information

	PIN NO.	CONNECTION	COMMENTS
<b>INPUTS</b>			
Analogue	3	LEFT HOT	
	15	LEFT COLD	
	16	GROUND	
	14	RIGHT HOT	
	1	RIGHT COLD	
	2	GROUND	
Digital	24	AES	No conflict between hot and cold in digital signals
	11	AES	
	21	GROUND	
<b>OUTPUTS</b>			
Analogue	6	LEFT HOT	
	18	LEFT COLD	
	19	GROUND	
	17	RIGHT HOT	
	4	RIGHT COLD	
	5	GROUND	
<b>POWER</b>			
	12	12-15 VDC	Observe that there is a bridge rectifier at the power supply input. This means that you can swap pins 12 and 25.
	25	0 V	
<b>RS232</b>			
	9	TX	Transmit
	22	RX	Receive
	10	GROUND	

# APPENDIX B

## MSD200 Input/Output Diagram



This diagram has been made only to help understand the functions of the MSD200/MSD200SA, and must not be seen as an electronic block diagram.



## **12 REGISTRATION**

Please fill in the enclosed Registration Card and mail or fax it to DK-Audio at address below to obtain the latest information about new MSD products. If your Registration Card is missing, you may use this page instead.

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

Country: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Unit serial no.: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Which features would you like to see in new versions of  
this model?  
\_\_\_\_\_  
\_\_\_\_\_

Comments:  
\_\_\_\_\_  
\_\_\_\_\_

**Mail or fax to:**

**DK-AUDIO • Marielundvej 37D • DK-2730 Herlev • Denmark**

**Phone: +45 44 53 02 55 • Fax: +45 44 53 03 67**

