MS 3
M20.02
M20.03

Audio Controller

user manual

Mach

section 1

INTRODUCTION

Safety Precautions

- Read this manual before operating the controller.
- To avoid the risk of electrical shock, do not remove any cover from the controller while it is connected to AC power.
- Do not expose the controller to rain or moisture.

General precautions

- Do not operate the controller near heat sources such as radiators, etcetera.
- Connect only to a power supply as marked on the controller.
- Do not drop the controller.
- Do not spill liquids onto or into the controller.
- Refer all service to a qualified technician.

Technical Background

When working with loudspeakers, there are 5 decisive factors for maximizing sound quality speaker lifetime:

- excursion control
- input power control
- frequency segmentation
- controller-generated distortion
- controller-generated noise

To avoid mechanical damage to the speaker units, the excursion of the speaker cones must be controlled. The M20.02, M20.03, and MS 3 accomplish this with a subsonic filter and limitation.

To avoid electrical damage to the speaker units, the power sent to the voice coils must be controlled. The M20.02, M20.03, and MS 3 use limiters for this purpose.

To get the best sound, the speaker units must be driven within the proper frequency range. This is accomplished by the cross-over in the M20.02, M20.03, and MS 3. In addition, the controller must not add distortion to the system.

To get the best signal to noise ratio, the noise floor of the controller must be below the general noise. This is achieved by surface mounted device (SMD) technology on double-sided printed circuit boards.

Printed in Denmark.

P/N 35020000, Rev. H

section 2

M20.02, M20.03, AND MS 3 DESIGN CONCEPT

The subsonic filter is a 24dB Butterworth for maximum sound quality and security.

The crossover filter configuration is a 24dB Linkwitz-Riley to get the best electronic summation of the crossover points and to optimize amplifier power.

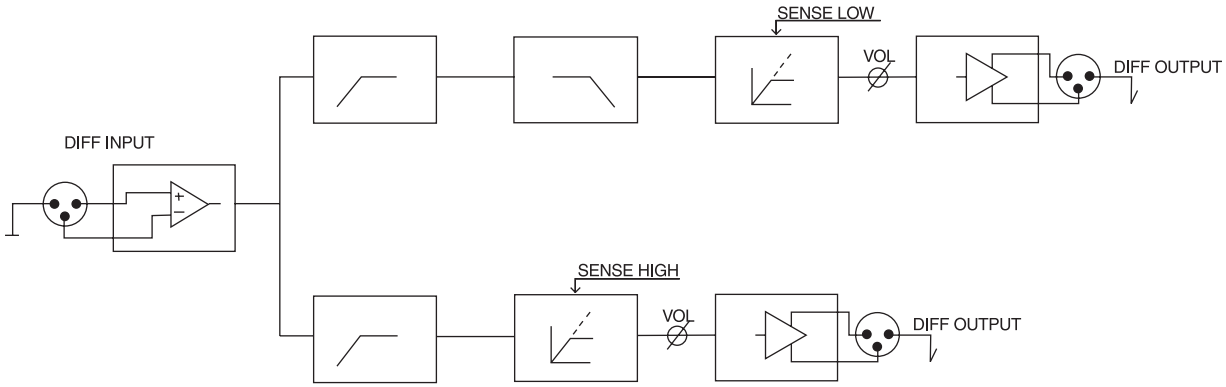
The feedback sense is electronically isolated from the controller signal to get the lowest noise and highest security for the amplifier.

The inputs and outputs are built as electronically servo-balanced transformers.

The components used in the controller are selected for audio quality, reliability, minimum distortion and noise.

In addition, the 20.03 includes an adjustable high-pass equalizer to pre-equalize the loudspeaker horns for correct frequency response.

M20.02 Block Diagram



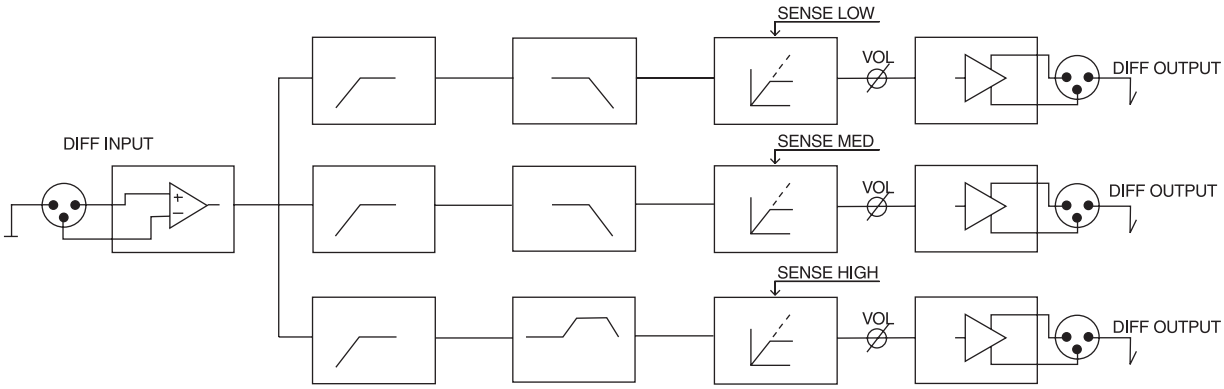
Input stage: The input signal first passes through an electronically balanced input stage and is then simultaneously directed to the low pass (LP) and high pass (HP) section.

Low pass section: The signal is first subsonically filtered with a 24dB Butterworth high pass filter. Thereafter the signal is filtered to its crossover point with a 24dB Linkwitz-Riley low pass filter. The signal then passes through the limitation section to the electronically servo-balanced output stage.

High pass section: The signal is first filtered to its crossover point with a 24dB Linkwitz-Riley high pass filter. The signal then passes through the limitation section to the electronically servo-balanced output stage.

The sense input on the controller measures the amplifier output directly. If the signal is too high compared to the settings of the internal DIP-switches, the signal to the amplifier will be reduced.

M20.03 and MS 3 Block Diagram



Input stage: The input signal first passes through an electronically balanced input stage and is then simultaneously directed to the low pass (LP), mid pass (MP) and high pass (HP) section.

Low pass section: The signal is first subsonically filtered with a 24dB Butterworth high pass filter. Thereafter the signal is filtered to its crossover point with a 24dB Linkwitz-Riley low pass filter. The signal then passes through the limitation section to the electronically servo-balanced output stage.

Mid pass section: The signal is subsonically filtered with a 24dB Linkwitz-Riley high pass filter at the right crossover point between the low and mid section. Thereafter, the signal is filtered to its crossover point between the mid and high section with a 24dB Linkwitz-Riley low pass filter. The signal then passes through the limitation section to the electronically servo-balanced output stage.

High pass section: The signal is first filtered to its crossover point with a 24dB Linkwitz-Riley high pass filter. The signal then passes through the limitation section to the electronically servo-balanced output stage.

The sense input on the controller measures the amplifier output directly. If the signal is too high compared to the settings of the internal DIP-switches, the signal to the amplifier will be reduced.

section 3
INSTALLATION

Mounting

The M20.02, M20.03, and MS 3 fit in a standard 19 by 1.75 inch rack unit.

Connectors

The input and output are fully balanced, but can be operated in unbalanced mode without problems. The plugs are standard 3-pin XLR connectors wired pin 1 = shield, pin 2 = (+), and pin 3 (-).

Voltage Switch

The voltage switch is found on the back of the controller. Be sure to select the voltage that matches your AC supply before connecting and operating the controller.

Mains Connection

By using a standard IEC receptacle and mains cable, all of the international safety requirements are met.

Speaker sense cable connection

Two types of wire sets are used. Type 1 wire sets single-color wires only. The colors are blue, green, black, white, brown, yellow, red, and orange. Type 2 wire sets have 4 single-color wires (brown, green, blue, and orange) and 4 two-color wires (white/brown, white/blue, white/orange, and white/green). Connect the left and right channel speaker sense input cables as described for your type of wire set. Note: The signal polarity each cable pair does not matter.

Type 1 wire sets

The **RED** and **ORANGE** wires are not used.

- Connect the **BLUE** and **GREEN** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **LOW FREQUENCY** speaker output.
- Connect the **BLACK** and **WHITE** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **MID FREQUENCY** speaker output. (M20.03 and MS 3 only)
- Connect the **BROWN** and **YELLOW** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **HIGH FREQUENCY** speaker output.
- Similarly, connect the wires from the left channel speaker sense input cable to the amplifier's left channel outputs.

Type 2 wire sets

The **BLUE** and **ORANGE** wires are not used.

- Connect the **WHITE/BROWN** and **WHITE/BLUE** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **LOW FREQUENCY** speaker output.
- Connect the **WHITE/ORANGE** and **WHITE/GREEN** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **MID FREQUENCY** speaker output. (M20.03 and MS 3 only)
- Connect the **BROWN** and **GREEN** wires from the right channel sense input cable to the positive (+) and negative (-) terminals of the amplifier's right channel **HIGH FREQUENCY** speaker output.
- Similarly, connect the wires from the left channel speaker sense input cable to the amplifier's left channel outputs.

Fuse Replacement

If the fuse blows, something is wrong. Be sure to fix the problem before replacing the fuse. Also be sure that the replacement fuse is of the correct rating and type.

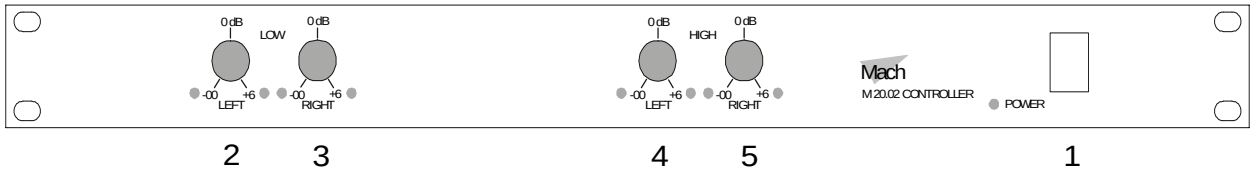
Limiter Settings

The limiter is set from DIP switches inside the cabinet. Before opening the cabinet, be sure that the main power cable is disconnected. The settings for Mach speakers are shown in section 5.

section 4
CONTROLS

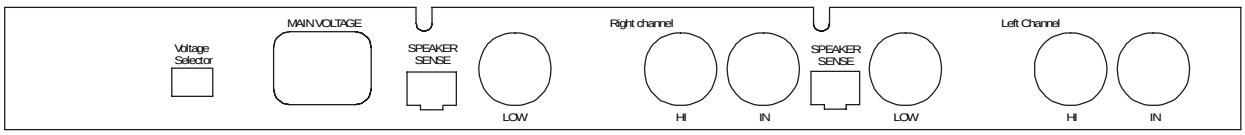
M20.02 Controls

Front Panel

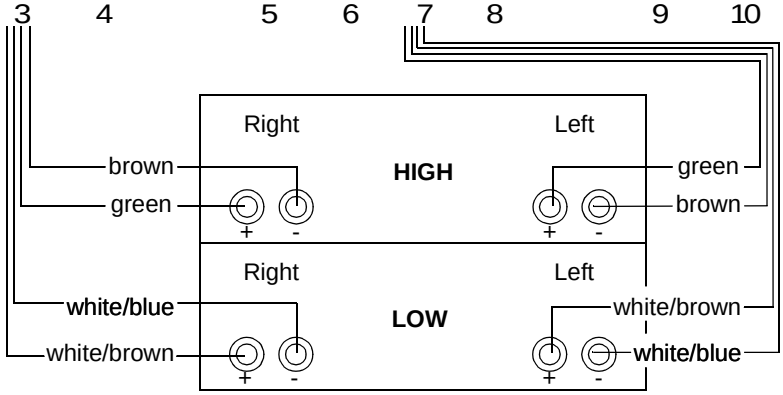


1. Main power switch
2. Low output - Left
3. Low output - Right
4. High output - Left
5. High output - Right

Rear Panel

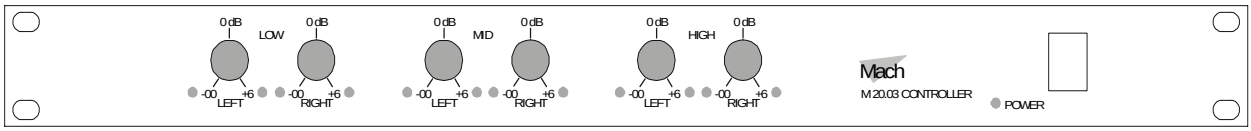


1. Mains voltage selector
2. Mains voltage connector
3. Right channel sense input
4. Right low output
5. Right high output
6. Right input
7. Left channel sense input
8. Left low output
9. Left high output
10. Left input



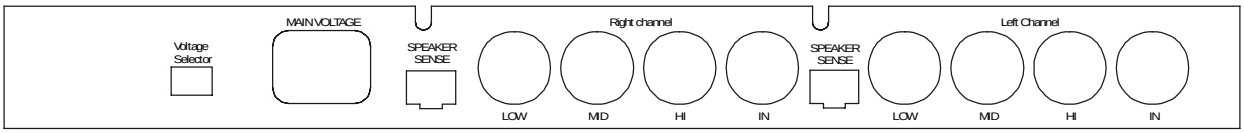
M20.03 and MS 3 Controls

Front Panel

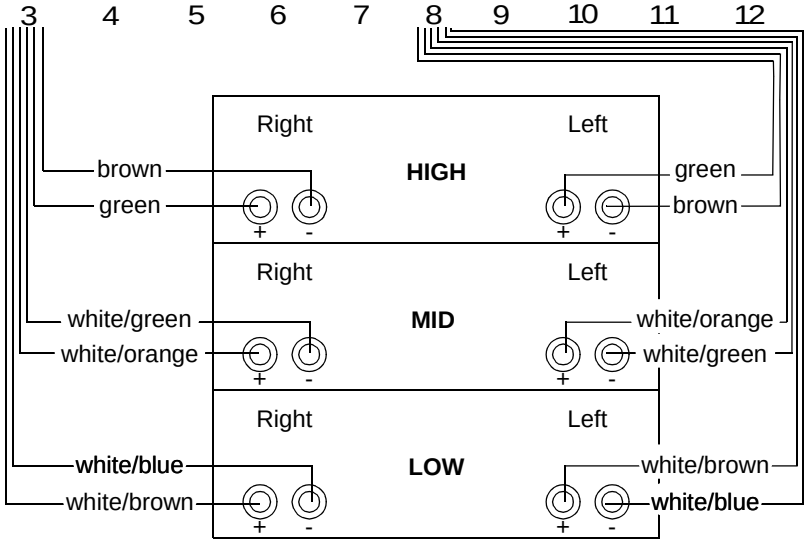


1. Main power switch
2. Low output - Left
3. Low output - Right
4. Mid output - Left
5. Mid output - Right
6. High output - Left
7. High output - Right

Rear Panel



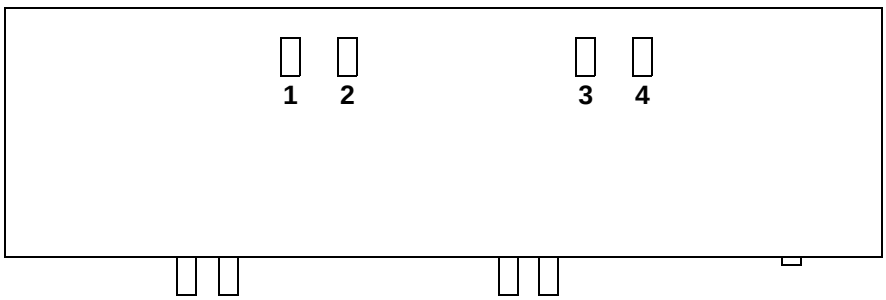
1. Mains voltage selector
2. Mains voltage connector
3. Right channel sense input
4. Right low output
5. Right mid output
6. Right high output
7. Right input
8. Left channel sense input
9. Left low output
10. Left mid output
11. Left high output
12. Left input



section 5
OPERATION

M20.02 Limiter Selection

To access the DIP-switches, remove the top plate. The DIP-switches are positioned as shown.



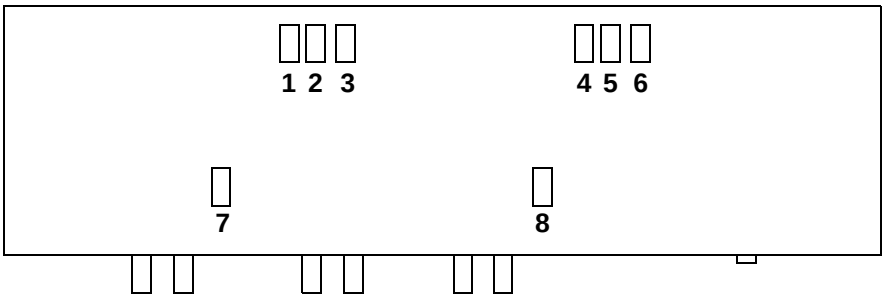
DIP-Switch Locations

0 = OFF 1 = ON	DIPs 1 and 3 123456	DIPs 2 and 4 123456
M12T	**-**	010010
M15T	**-**	001000
M30T	**-**	001000
M72i	-	111000
M82i	-	100000
M125i		011000
M127i		010100
M129i		010000
M154i	-	001000
M156i	-	001000
M151i	011000	-
M152i	011000	-
M181T	000010	-
M182i / M182T	000010	-

DIP-switch settings, M20.02 Audio Controller

M20.03 Limiter & Equalization Selection

DIP-switches 1 - 6 set the limiter levels for each output channel. DIP-switches 7 and 8 set the equalization level.

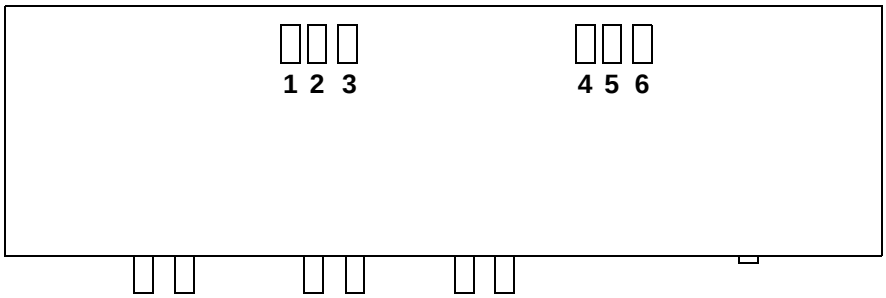


M20.03 DIP-Switch Locations

0 = OFF 1 = ON	**DIPs 1 and 4** 123456	**DIPs 2 and 5** 123456	**DIPs 3 and 6** 123456	**DIPs 7 and 8** 123456
M12T	**-**	010000	111000	-
M15T	**-**	001000	111000	-
M30T	**-**	001000	111000	-
M127i	-	011000	111111	100010
M129i	-	011000	111000	110010
M151i	011000	-	-	-
M152i	011000	-	-	-
M154i	-	001010	111100	111100
M156i	-	001010	111000	100110
M181T	000010	-	-	-
M182i / M182T	000010	-	-	-

DIP-switch settings, M20.03 Audio Controller

MS 3 Limiter Selection



MS 3 DIP-Switch Locations

0 = OFF **1 = ON**	**DIPs 1 and 4** 123456	**DIPs 2 and 5** 123456	**DIPs 3 and 6** 123456
MS 1262	-	000010	000100
MS 118	000010	-	-

DIP-switch settings, MS 3 Audio Controller

section 6

SPECIFICATIONS

M20.02 Specifications

INPUT

- TYPE: ..... Electronically balanced
- IMPEDANCE: ..... 47k Ohm
- OPERATING LEVEL ..... 0 dB
- MAX. INPUT: ..... +21 dB V (10.5V)

SENSE INPUT

- TYPE: ..... Amp output sense
- MAX. INPUT: 110V

OUTPUT

- IMPEDANCE: ..... 50 Ohm
- MAX. OUTPUT: ..... +21dBV (10.5V)
- BANDWIDTH: ..... 35 Hz - 110 Hz, 110 Hz - 160 kHz
- THD: 0.0015%
- S/N: ..... 112 dB

CONTROLS

- OUTPUT: ..... -00---+6dB

DIP SWITCHES

- 1-3: ..... Limiter settings low
- 2-4: ..... Limiter settings high

INDICATORS

- 4 LED GREEN: ..... SIGNAL SEND TO OUTPUT
- 4 LED RED: ..... LIMITERS IN FUNCTION
- 1 LED BLUE: ..... MAIN POWER

POWER SUPPLY

- MAINS VOLTAGE: ..... 100-120/220-240 VAC 50-60 Hz
- POWER CONSUMPTIONS: ..... 9 WATT
- FUSE: ..... 100 mA
- MAINS CONNECTION: ..... STANDARD IEC RECEPTACLE

PHYSICAL

- DIMENSIONS (HxWxD): ..... 1.75 x 19 x 5 in (44 x 482 x 128 mm)
- NET WEIGHT: ..... 2.2 kg
- SHIPPING WEIGHT: ..... 3.0 kg

M20.03 and MS 3 Specifications

INPUT

- TYPE: ..... Differential
- IMPEDANCE: ..... 47k Ohm
- OPERATING LEVEL ..... 0 dB
- MAX. INPUT: ..... 21 dBV (10.5 V)

SENSE INPUT

- TYPE: ..... Amp voltage
- MAX. INPUT: 110V

OUTPUT

- IMPEDANCE: ..... 50 Ohm
- MAX. OUTPUT: 20dBV
- BANDWIDTH: ..... 35-110 Hz, 110-1200 Hz, 1.2-120KHz
- THD: 0.0015%
- S/N: ..... 112 dB

CONTROLS

- OUTPUT: ..... -00 - +6dB

DIP SWITCHES

- 1-4: ..... Limit sense LOW
- 2-5 ..... Limit sense MID
- 3-6 ..... Limit sense HIGH
- 7-8 (M20.03 only) ..... Eq. HIGH

INDICATORS

- 6 LED GREEN: ..... SIGNAL SEND TO OUTPUT
- 6 LED RED: ..... LIMITERS IN FUNCTION
- 1 LED BLUE: ..... MAIN POWER

POWER SUPPLY

- MAINS VOLTAGE: ..... 100-120/220-240 VAC 50-60 Hz
- POWER CONSUMPTIONS: ..... 9 WATT
- FUSE: ..... 100 mA
- MAINS CONNECTION: ..... Standard IEC receptacle

PHYSICAL

- DIMENSIONS (HxWxD): ..... 1.75 x 19 x 5 in (44 x 482 x 128 mm)
- NET WEIGHT: ..... 2.2 kg
- SHIPPING WEIGHT: ..... 3.0 kg