

PCB 75025

5.1 Introduction

This plug-in p.c.b. contains two active filters externally connected in cascade, capable of being separately switched in circuit under the control of the microcomputer.

5.1.1 CCIR 468-2

The CCIR 468-2 filter meets the requirements of Recommendations 468-1 to 468-3. The MJS401D fully meets the headroom specifications of the later revisions of the standard. On standard versions of the MJS401D, software interlocks ensure that the specified "QUASI-PEAK" rectifier is automatically selected when CCIR 468-2 is in use. CCIR 468-3 and DIN 45 405 weighted noise specifications are equivalent. Filter specifications are shown in Figure 5.1.2, Figure 5.1.3 and Table 5.1.1 following.

5.1.2 CCIR ARM

The CCIR gain characteristic can be modified (overall drop of 6 dB) under microcomputer control to conform to the "average reading meter" (A.R.M.) rectifier standard for noise measurements, according to the Dolby recommendation. In the standard MJS401D, software interlocks ensure that when "CCIR ARM" is selected, the correct "AVG" rectifier is enabled.

5.1.3 High-pass filter

The high-pass filter is a 36 dB/octave filter, having a maximally flat response with a steep roll-off below 400 Hz to filter out 50 Hz mains hum and its low-order harmonics.

The block diagram is shown in Figure 5.1.1 below with all filters in the bypassed or disabled condition.

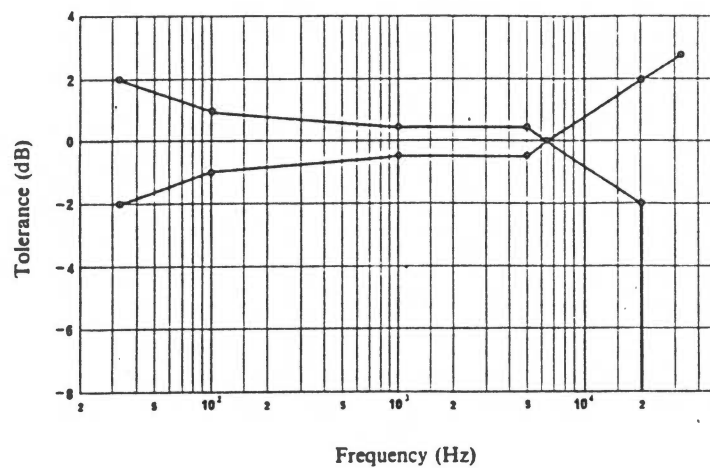


Figure 5.1.3 Tolerance of the Weighting Network

Frequency, Hz	Response, dB	Tolerance, dB
31.5	-29.9	±2.0
63	-23.9	±1.4
100	-19.8	±1.0
200	-13.8	±0.8
400	- 7.8	±0.5
800	- 1.9	±0.3
1000	0	±0.2
2000	+ 5.6	±0.5
3150	+ 9.0	±0.5
5000	+11.7	±0.5
6300	+12.2	0
7100	+12.0	±0.2
8000	+11.4	±0.4
9000	+10.1	±0.6
10000	+ 8.1	±0.8
12500	0	±1.2
14000	- 5.3	±1.4
16000	-11.7	±1.6
20000	-22.2	±2.0
31500	-42.7	+2.8 -∞

Table 5.1.1 Frequency Response of the Weighting Network

5.2 Circuit description

5.2.1 CCIR Filter

The output from the Downstream Filter p.c.b. is applied to SKT2/8 (CCIR FILTER INPUT).

In the inactive mode (logic 0 on SKT2/6), the signal is routed via the analogue switch IC4/3,4 directly to SKT1/1 (CCIR FILTER OUTPUT); i.e. the CCIR filter is bypassed.

Furthermore, with driver input IC3/10 at logic 0, input IC1a/10 of the CCIR filter is taken to earth via IC3/5,6 to prevent breakthrough due to overloading of the filter, which has a gain greater than 1 between 1 kHz and 12.5 kHz.

In the active mode (logic 1 on SKT2/6), with the switch driver input IC3/10 at logic 1, switch IC3/5,6 opens to unmute the CCIR filter input and routes the signal via IC3/8,9 to the non-inverting input of IC1a/10.

In addition, with driver input IC4/15 at logic 1, switch IC4/3,4 is open and the filter output is now connected via IC4/1,16 to SKT1/1.

The +5 V on pin 12 is derived by potential divider R2,3 from the +18 V rail and decoupled by C17.

The filter path is as follows:

Operational amplifier IC1a has 0 dB to approximately 0.8 dB gain. Any insertion loss is trimmed by VR1, giving 12.2 dB overall gain at 6.3 kHz when the CCIR filter is switched in.

Normally, the output from IC1a/8 is passed via C1, R6 and switch IC3/3,4 to voltage follower IC1b. However, when A.R.M. is activated (logic 1 on SKT2/7), switch IC3/3,4 opens and the signal is routed via the attenuator R7, R9, R8 and IC3/1,16 which introduces an insertion loss of 6 dB (ARM gain characteristics).

The signal from output IC1b/14 feeds two equal-value Sallen and Key filters comprising IC1c, IC1d and their associated RC feedback networks.

The output from IC1d/7 is fed via C7 and switch IC4/1,16 to SKT1/1 (CCIR FILTER OUTPUT).

5.2.2 High-pass Filter

The output from the CCIR filter (SKT1/1) is connected via the motherboard to the HP filter input on SKT1/2. This input is directly connected to the non-inverting input of op amp IC2a/10 and also to the filter bypass switch IC4/6,5.

In the inactive state (logic 0 on SKT1/4), switch IC4/6,5 bypasses the signal to output SKT1/3 and with switch IC4/8,9 open, the HP filter output is disconnected.

In the active state (logic 1 on SKT1/4), a logic 1 on driver input IC4/10 opens the bypass switch IC4/6,5 and connects the HP filter output via IC4/8,9

to SKT1/3.

The filter path is as follows:

The feedback resistor VR2 of op amp IC2a is adjusted to give no change in level when the high-pass filter is switched in; i.e. 0 dB insertion loss.

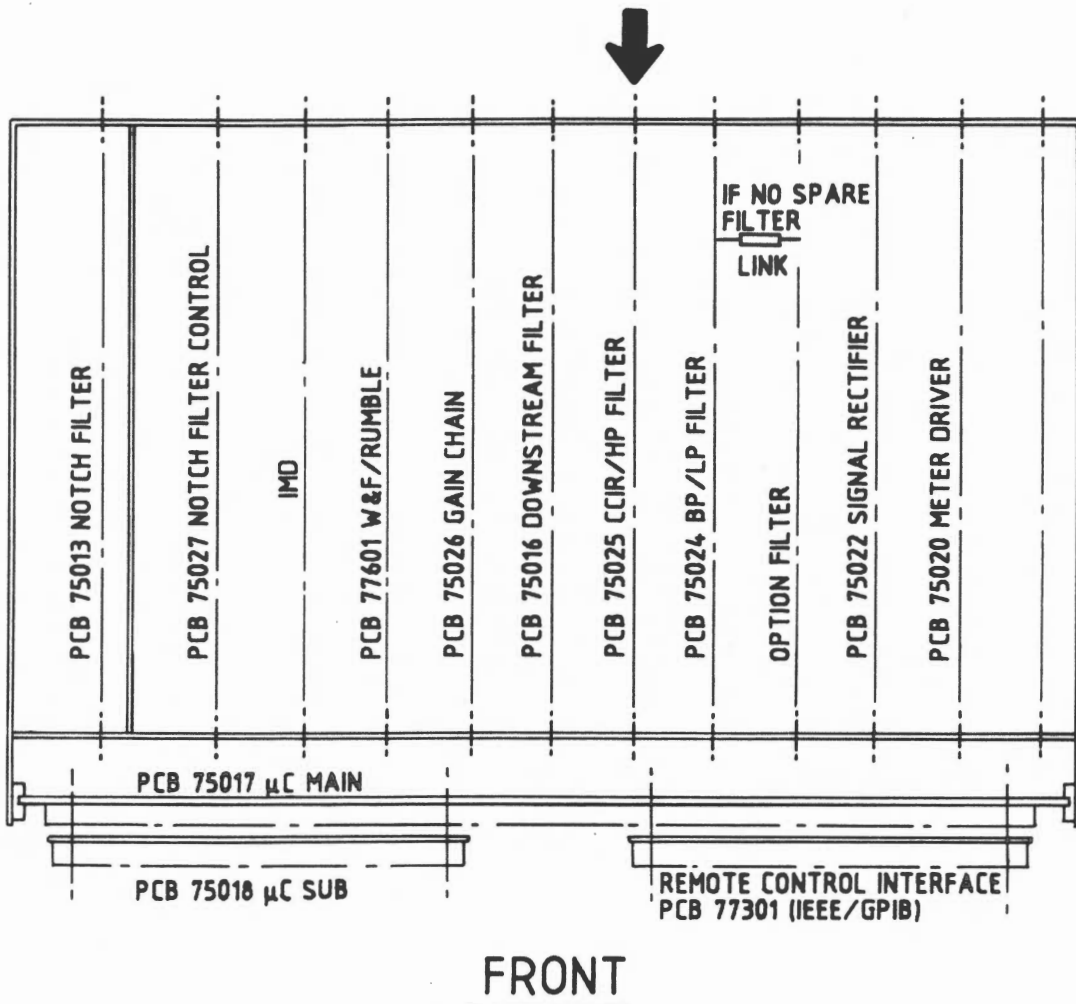
The output on IC2a/8 feeds a three-stage, high-pass, active Sallen and Key filter, comprising voltage followers IC2b, IC2c, IC2d and their associated RC feedback components. The resultant output via C14 gives a maximally flat characteristic that rolls off at 36 dB per octave below 400 Hz. The output is fed via IC4/8,9 to SKT1/3 (HP FILTER OUTPUT).

5.3 Removal/Replacement

Switch off the MJS401D and remove the mains lead.

Remove the four screws retaining the top cover. Pull the top cover straight up.

With the instrument facing you, the CCIR/HP filter card is installed in the 7th slot from the left in the main card frame. Verify by noting the printing on the motherboard.



MJS401D PCB Location Guide

Remove the card by grasping the top corners and gently pulling up.

Replacement is the opposite of removal. Carefully line up the connectors before pushing down and ensure the card is properly held within the guides.

Extender card PCB 75032 may be used to facilitate repair and calibration.

5.4 Fault Finding

Use extender card PCB 75032.

5.4.1 CCIR 468-2 Noise Weighting Filter Activation

Select the "CCIR 468-2" filter on the instrument front panel. The red LED on the front panel should illuminate.

The LED labelled "Filter 1" on the Extender Card should illuminate indicating microcomputer control output is functional.

If this does not illuminate, remove the CCIR/HP card from the extender. If the Filter 1 LED now illuminates, a fault in the logic circuit input IC3/10, R4, or IC4/15 is likely. If Filter 1 still remains off, check for +5 V on PL2/6. If this is missing the fault is in the microcomputer, motherboard or interconnections.

If the logic circuits appear correct, check for signal continuity through IC3/8 to IC3/9 and through IC4/1 to IC4/16. Also check presence of +5 V on IC3/12 and IC4/12.

Failure of the signal to appear at IC3/8 indicates a failure elsewhere in the system, probably on the Downstream Filter PCB (see section 6), motherboard or connections between the two.

5.4.2 High-pass Filter Activation

Select the "400 Hz" filter on the instrument front panel. The red LED over the switch should illuminate. Failure to illuminate could indicate failure of the switch, LED, encoders or microcomputer system. See section 12 for switch and encoder repair, and section 3 for microcomputer system repair.

The LED labelled Filter 2 on the Extender PCB should illuminate indicating that the microcomputer control output, switch and switch encoder are functional.

If this does not illuminate, remove the CCIR/HP card from the extender. Illumination of the Filter 2 LED now indicates a likely fault in the logic circuit input IC4/10, R24. If Filter 2 LED still remains off, check for +5 V on PL1/4. If this is missing the fault is in the microcomputer, motherboard or interconnections.

If the logic circuits appear correct, check for signal continuity through IC2a/10 to IC2a/8 and through IC4/8 to IC4/9.

Failure of the signal to appear at IC2a/10 indicates a likely failure elsewhere in the system, probably on the CCIR filter section of this PCB, or on the motherboard connector mating with SKT1.

5.5 Calibration

First assure that basic functionality is correct. Extender card PCB 75032 is useful but not essential.

5.5.1 CCIR 468 Filter - If the MJS401D does not have Extra Functions

MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	QUASI-PK	EXP	---	0	0

Set Gain Calibration

- 1) Input 0 dB (0.775 V) at 6.3 kHz to the test set. Adjust the source to give exactly "0" on the meter.
- 2) Select "CCIR 468-2" filter on.
- 3) Set "dB COARSE" to "+10" and "dB FINE" to "+2". Adjust VR1 (nearest the front of the test set) to read exactly +0.2 on the meter.

Check LF Response

- 4) Ensure all filters are off. Set "dB COARSE" to "0" and "dB FINE" to "0". Set source frequency to exactly 100 Hz. Adjust the source to set the level to read exactly "0" on the meter.
- 5) Turn "CCIR 468-2" filter on. Set "dB COARSE" to "-20". The meter should read between -1.8 and +0.8 dB.

Check Mid-Band Response

- 6) Set "dB COARSE" to "0". All filters off. Adjust the source frequency to exactly 1 kHz and the level to read "0" on the meter.
- 7) Turn "CCIR 468-2" filter on. The meter should be between +0.5 and -0.5 dB.

Check HF Response

- 8) Turn all filters off. Set source frequency to exactly 12.5 kHz. Adjust source level to read "0" on the meter.
- 9) Turn the CCIR 468-2 filter ON. The meter should read between +1.2 dB and -1.2 dB.

Check CCIR ARM

MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	AVG	EXP	---	0	0

- 10) Set source frequency to 6.3 kHz and adjust the source level to read "0" on the meter.

11) Set "dB COARSE" to "+10" and "dB FINE" to "-4". Switch "CCIR ARM" filter in. Meter should read between +0.3 and +0.1 dB.

5.5.2 CCIR 468 Filter - If the MJS401D has Extra Functions

MJS401D Front Panel Setup

Input	Load	Func't'n	Filters	Wtd/Unwtd	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	---	Quasi-Pk	dB Exp	---	0	0

Set Gain Calibration

- 1) Input 0 dB (0.775 V) at 6.3 kHz to the test set. Adjust the source to give exactly "0" on the meter.
- 2) Select "Extra Funct", "Noise CCIR 468-3" and "Wtd".
- 3) Set "dB COARSE" to "+10" and "dB FINE" to "+2". Adjust VR1 (nearest the front of the test set) to read exactly +0.2 on the meter.

Check LF Response

- 4) Select LEVEL function. Ensure all filters are off. Set "dB COARSE" to "0" and "dB FINE" to "0". Set source frequency to exactly 100 Hz. Adjust the source to set the level to read exactly "0" on the meter.
- 5) Select "Extra Funct". Set "dB COARSE" to "-20". The meter should read between -1.8 and +0.8 dB.

Check Mid-Band Response

- 6) Set "dB COARSE" to "0". All filters off. Adjust the source to 1 kHz frequency and the level to read "0" on the meter.
- 7) Select "Extra Func". The meter should be between +0.5 and -0.5 dB.

Check HF Response

- 8) Select "Level". Set source frequency to exactly 12.5 kHz. Adjust source level to read "0" on the meter.
- 9) Select "Extra Func". The meter should read between +1.2 dB and -1.2 dB.

Check CCIR ARM

MJS401D Front Panel Setup

Input	Load	Func't'n	Filters	Wtd/Unwtd	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	---	Avg	dB Exp	---	0	0

- 10) Set source frequency to 6.3 kHz and adjust the source level to read "0" on the meter.
- 11) Set "dB COARSE" to "+10" and "dB FINE" to "-4". Switch "CCIR ARM" filter in. Meter should read between +0.3 and +0.1 dB.

5.5.3 HP Filter

MJS401D Front Panel Setup

Input	Load	Function	Filters	Rectifier	Scale	Dist'n	Coarse	Fine
A	Off	Level	Off	RMS	dB Exp	---	0	0

Set Mid-Band Gain Calibration

- 1) Input 0 dBu (0.775 V) to the test set at 1 kHz.
- 2) Adjust the source level to read exactly "0" on the meter.
- 3) Select "400 Hz" filter on.
- 4) Set VR2 (the preset nearest the rear of the test set) to adjust the meter to read exactly "0".
- 5) Switch "400 Hz" filter on and off several times to confirm no level change.

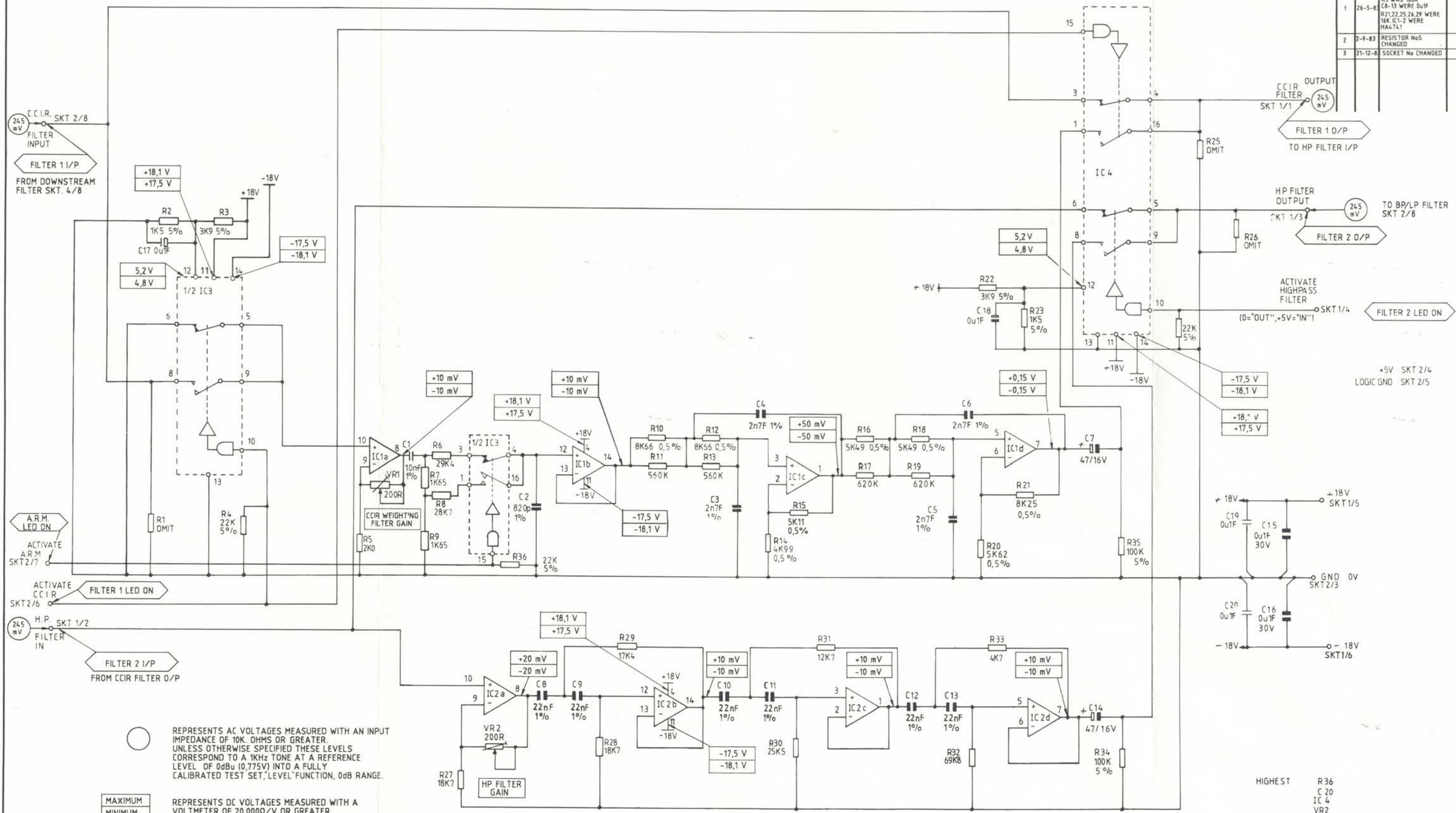
Check LF Response

- 6) Set the source frequency to 400 Hz.
- 7) Select all filters off. Set source level to read exactly "0" on the meter.
- 8) Select 400 Hz filter on. Set "dB FINE" to "-3".
- 9) Adjust the source frequency to read exactly "0" on the meter. The frequency should be between 380 Hz and 420 Hz.

Check Mid Band and HF Response

- 10) From 600 Hz to 22 kHz the meter reading with or without the filter selected should be within ± 0.1 dB.

REVISION			
NO	DATE	CHANGE	APPROVED
1	26-5-83	SOME TOL CHANGED R3 WAS 100K C8-13 WERE 0.1uF R21,22,25,26,29 WERE 18K. IC1-2 WERE HA4741	
2	2-9-83	RESISTOR NOS CHANGED	
3	21-12-83	SOCKET No CHANGED	



ALL RESISTORS 1% UNLESS OTHERWISE STATED

NEUTRIK AG		TITLE	
Unit 2, Samuel Whites Industrial Estate, Medina Road, Cowes, Isle of Wight, PO31 7LP, GB Tel: (0983) 299960 Telefax: (0983) 299142		CCIR & HP FILTER CIRCUIT DIAGRAM PCB 75025	
TOLERANCES - UNLESS OTHERWISE STATED Linear Millimetres ±0.4mm Angular Degrees ±0.25°		USE MJS 401D TEST SET	
MATERIAL ORIGINAL SCALE		DRAWING NO	
DATE 11 FEB 1983		REV	
CHECKED MJS		PROJECT NO	
DATE		TYPE	
		SHEET NO	
		SIZE	
		3	