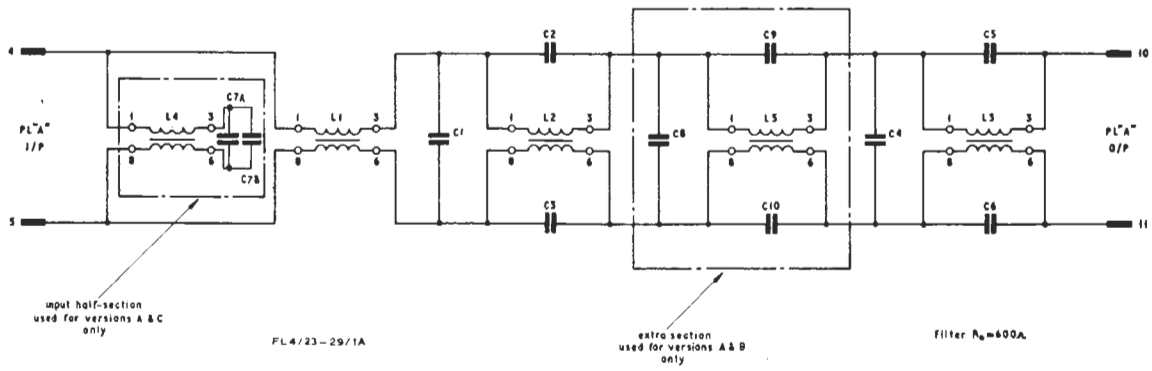
LOW–PASS FILTERS FL4/23 TO FL4/29



Filter	*FL4/23*	*FL4/24*	*FL4/25*	*FL4/26*	*FL4/27*	*FL4/28*	*FL4/29*
L1	18A/194 16·5 mH overall	21A/152 15·0 mH overall		21A/148 12·5 mH overall	18A/193 10·8 mH overall	21A/196 21·0 mH overall	21D/104 18·5 mH overall
L2, L5	18A/192	18A/191		21A/142	21A/139	21A/194	21D/102
L3	18A/191	21A/144		21A/142	21A/140	21A/193	21D/101
L4	18A/193	21A/147		21A/146	21A/145	21A/195	21D/103
C1	0·0369	0·0332		0·0273	0·0232	0·0488	0·0429
C2, C3, C9, C10	0·0867	0·0828		0·0762	0·0707	0·097	0·092
C4	0·0235	0·0207		0·0168	0·0142	0·0317	0·027
C5, C6	0·080	0·0727		0·0607	0·0526	0·1027	0·0902
C7A	0·01539	0·0142		0·012	0·01	0·0198	0·018
C7B*	0·0018	0·0015		0·0012	0·0015	0·0022	0·0015
C8	0·0172	0·015		0·0115	0·0092	0·0247	0·0202

*C7B is disconnected on A Receive versions

Fig. 1. Circuit of Filters FL4/23 to FL4/29

Introduction

The filters FL4/23 to FL4/29 are 600-ohm low-pass networks, first designed for use in sound automatic monitors MN2M/3 to MN2M/6. Their cut-off frequencies are shown in Table 1. The units are constructed on standard plug-in equaliser chassis CH2/2 and may be mounted in a PN3/23-type housing.

TABLE 1

Code	*Cut-off Freq. kHz*
FL4/23	9·25
FL4/24	10·25
FL4/25	11·25
FL4/26	12·25
FL4/27	14·25
FL4/28	7·25
FL4/29	8·25

Circuit Description (Fig. 1)

These are balanced low-pass filters in each section of which two series arms of equal inductance are provided by two coupled windings with a single core. The mutual inductance between the windings causes each to present the required inductance for a balanced filter section, i.e., half the inductance required for an equivalent unbalanced section. This is a method of obtaining two balanced-inductance series arms that is economical in cost and space compared to the use of separate inductors.

For each cut-off frequency, four versions of the filter are possible, distinguished by the letter A, B, C or D suffixed to the appropriate code.

The B and D versions of filters FL4/23 to FL4/29 are normally used with their inputs connected in parallel with the inputs of high-pass filters FL3/8 to FL3/14 respectively. The input impedance of these complementary pairs is about 600 ohms.

The A and C versions are used without the high-pass filters and therefore incorporate an input terminating half-section.

The A and B versions are equipped with an additional section, which provides extra rejection at the monitor signalling tone frequencies. Rejection of the signalling tone is about 55 dB for the A and B versions, and 30 dB for the C and D versions.

Where sound automatic monitors are connected to three-winding repeating coils at the sending and receiving ends of lines, modified A versions of the FL4/23 to FL4/29 are used at the receiving ends in conjunction with the high-pass filters FL3/8 to FL3/14 respectively, the two filters being connected to separate windings of the receiving end repeating coils. Such A versions have slightly reduced capacitance in the input shunt arm (C7B being disconnected) and these are designated A *Receive* versions to distinguish them from the basic A versions, known as the A *Send* versions, used at the sending ends of lines.

Adjustment and Testing

Apparatus

Avometer model 8
Tone source TS/10 (or, preferably, a source with finer frequency adjustment for trimming the higher-frequency filters)
Frequency counter
A.C. test meter ATM/1
Two 600-ohm 1:1 balanced repeating coils
Inductance bridge

Adjustment, A and B Versions

1. Check that there is d.c. continuity between PLA4 and PLA10, and between PLA5 and PLA 11.
2. Apply the output of the tone source, via a repeating coil, across C8. Join the ATM/1 (connected to present 600 ohms input impedance) via a repeating coil to PLA10 and PLA11. Adjust L3 and L5 for maximum rejection, as shown by the ATM/1, at the frequencies given in Table 2. In each instance set the tone source exactly to the frequency to be rejected by measurement on the counter, but disconnect the counter before adjusting the inductor. With each inductor, ensure that it is true resonance that is obtained rather than the condition of maximum inductance (which may be obtained when an associated tuning capacitor is incorrect in value).
3. Apply the output of the tone source, via a repeating coil, to PLA4 and PLA5. Adjust L2 and L4 (if fitted) for maximum rejection at the frequencies given in Table 2, using the ATM/1 and counter as in step 2.
4. Check the frequency response of the filter, as described later, and readjust L2 and L5 if necessary to obtain the required response.
5. To convert a Type-A filter to the *Receive* version, disconnect one end of C7B.

Note that L1 should not require adjustment, but should have been preset at manufacture to the total series inductance shown in Fig. 1, measured at 1 kHz between terminals 1 and 8 while 3 and 6 are linked. This can be checked on an inductance bridge.

Adjustment, C and D Versions

Follow the procedure for the A and B versions, but in steps 2 and 3, apply the tone source to PLA4 and PLA5 for the adjustment of L3, L2 and L4 (if fitted). In step 4, adjust L2.

Testing Frequency Response

Connect the tone source, via a repeating coil, to PLA4 and PLA5. Join the ATM/1 (connected to present 600 ohms input impedance) via a repeating coil to PLA10 and PLA11. Check that the insertion loss characteristic conforms to the figures given in Tables 3 to 9 for the type of filter under test, after allowance has been made for the loss in the repeating coils. (The tabulated response to be checked is that measured between 600-ohm terminations. In actual use, the

response of the B and D versions operated in parallel with their complementary high-pass filters will approximate to that of the A and C versions respectively.)

An A *Rèceive* version filter should give approximately the A *Send* response tabulated, or can be checked against this response while C7B is temporarily connected.

TABLE 2

Frequencies at which Inductors are Tuned for Maximum Rejection, kHz

Filter	*L3*	*L5*	*L2*	*L4*
FL4/23	10·83	9·75	9·65	11·60
FL4/24	12·00	10·75	10·65	12·90
FL4/25				
FL4/26	14·35	12·75	12·65	15·40
FL4/27	16·70	14·75	14·65	17·90
FL4/28	8·50	7·75	7·65	9·10
FL4/29	9·65	8·75	8·65	10·30

TABLE 3

Frequency Responses of FL4/23 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*			
	A	*B*	*C*	*D*
<2	0·25	0·25	0·15	0·15
7	0·35 ±0·1	0·7 ±0·2	0·25 ±0·1	0·5 ±0·2
8	0·6 ±0·2	1·5 ±0·3	0·3 ±0·1	0·75 ±0·2
9	3·0 ±0·5	5·5 ±1·0	2·5 ±0·5	3·5 ±0·5
9·25	14 ±2	16 ±2	9 ±2	10 ±2
9·6	>55	>55	>30	>30
9·8	>55	>55	>30	>30
10·8	>45	>45	>40	>40
>12	>30	>30	>25	>25

TABLE 4

Frequency Responses of FL4/24 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*			
	A	*B*	*C*	*D*
<2	0·25	0·25	0·15	0·15
8	0·3 ±0·1	0·8 ±0·2	0·25 ±0·1	0·5 ±0·2
9	0·5 ±0·2	1·5 ±0·3	0·3 ±0·1	0·75 ±0·2
10	3·0 ±0·5	5·5 ±1·0	2·5 ±0·5	3·5 ±0·5
10·25	15 ±2	18 ±2	10 ±2	11 ±2
10·6	>55	>55	>30	>30
10·8	>55	>55	>30	>30
12·1	>45	>45	>40	>40
>13	>30	>30	>25	>25

TABLE 5

Frequency Responses of FL4/25 versions A (Send), B, C and D

Information not available

TABLE 6

Frequency Responses of FL4/26 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*			
	A	*B*	*C*	*D*
<3	<0·25	<0·25	<0·25	<0·25
11	0·5 ±0·2	1·5 ±0·3	0·5 ±0·2	1·0 ±0·25
12	4·0 ±1·0	5·5 ±1·5	3·0 ±1·0	5·0 ±1·0
12·25	15·0 ±3·0	18·0 ±3·0	11·0 ±2·0	13·0 ±2·0
12·6	>55	>55	>28	>30
12·8	>55	>55	>28	>30
14·35	>60	>55	>40	>40
>13	>30	>25	>25	>20

TABLE 7

Frequency Responses of FL4/27 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*							
	A		*B*		*C*		*D*	
<4	<0·25		<0·25		<0·25		<0·25	
13	0·6	±0·2	2·0	±0·4	0·5	±0·2	1·0	±0·3
14	5·0	±1·0	5·5	±1·5	4·0	±1·0	5·0	±1·5
14·25	18·0	±3·0	20·0	±3·0	12·0	±2·0	14·0	±2·5
14·6	>55		>55		>28		>30	
14·8	>55		>55		>28		>30	
16·7	>60		>55		>40		>40	
>15	>30		>30		>25		>20	

TABLE 8

Frequency Responses of FL4/28 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*							
	A		*B*		*C*		*D*	
<1	<0·25		<0·25		<0·15		<0·15	
6	0·25	±0·1	1·5	±0·3	0·15	±0·1	0·6	±0·2
7	1·5	±0·5	5·0	±2·0	1·0	±0·5	2·5	±0·5
7·25	13·0	±2·0	16·0	±3·0	6·0	±1·5	8·5	±2·0
7·6	>55		>55		>28		>30	
7·8	>55		>55		>28		>30	
8·5	>60		>55		>40		>40	
>8	>30		>25		>25		>20	

TABLE 9

Frequency Responses of FL4/29 versions A (Send), B, C and D

Freq. (kHz)	*Attenuation (dB)*							
	A		*B*		*C*		*D*	
<1	<0·25		<0·25		<0·15		<0·15	
7	0·3	±0·2	1·5	±0·3	0·25	±0·1	0·7	±0·2
8	2·0	±0·5	5·0	±2·0	2·0	±0·5	3·0	±0·5
8·25	11·0	±2·0	17·0	±3·0	7·5	±1·5	10·0	±2·0
8·6	>55		>55		>28		>30	
8·8	>55		>55		>28		>30	
9·65	>60		>55		>40		>40	
>9	>30		>25		>25		>20	

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