

Series 400 & 500

421/521 Stereo Amplifier

423/523 AM-FM Tuner

424/524 FM Tuner

425/525 FM Stereo Tuner amplifier

426/526 AM-FM Stereo Tuner amplifier

M4/M8 Stereo Radio Decoder

Components

TRANSISTORS

Circuit Ref.	Type	Typical voltages —volts (Positive earth)		
		Collector	Base	Emitter
TR1	AF106	12	1.7	1.4
TR2	AF115	12	2.4	2.2
TR3	AF116	9.8	3	2.8
TR4	AF116	9.8	3	2.8
TR5	AF116	9.8	3	2.8
*TR6	AC139	2.3	0.02	0
TR7	AF116	7.2	2.3	2.1
TR8	AC128	7	1.4	1.3
TR9	AC128	3.5	0.6	0.5
TR10	AC128	7	0.02	0
TR11	AF116	6	1.3	1.1
TR12	AF116	6	1.3	1.1
†TR13	BC109 or ME4102	0.02	11	12
TR14	BSV44A	50	0.02	0
TR14A	AC128	12	0.02	0
TR14B	BSV44A	50	0.02	0
TR15	AF116	5	1.8	1.5
TR16	AF117	9.7	1.5	1.3
TR17	AF116	8.3	2.2	2
TR18	AF116	10	1.6	1.4
TR19	BC109 or ME4102	5	14.3	14.5
TR20	AC191 5	21	8	7.5

Circuit Ref.	Type	Typical voltages —volts (Positive earth)		
		Collector	Base	Emitter
TR21	AC191 5	17	8.2	8
TR22	XK1112	8.5	0.52	0.12
TR22A	AC191 7	8.5	0.52	0.12
TR22B	XK1112	8.5	0.52	0.12
TR23	AC139H	32	8.5	8
TR24	AC139Z	50	25.7	25.5
TR25	AL102	50	25.5	25
TR26	AC139Z	25	0.4	0.27
TR27	AL102	25	0.27	0.02
TR28	AC139H	51	12.2	12
TR29	AL102	70	50.5	50
TR30	AC139H	70	51	50.5
TR31	ME4102	2.7	5.3	5.5
TR32	AC134—AC1914	7.5	2.7	2.6
TR33	BSV44A	32	8.5	8
TR34	BSV44A	50	25.7	25.5
TR36	BSV44A	25	0.4	0.27

Notes:

- 1 Voltages must be measured under no signal conditions with volume control at minimum.
- 2 Readings of base voltages may be affected by the meter used.
- 3 These typical readings assume that the HT is correctly set at 50 volts $\pm$ 1 volt.
- 4 Transistors TR19 to TR27 inclusive are duplicated in each channel.
- 5 All transistors shown above, except BC 109, are specially selected types and should be obtained from Armstrong Audio Ltd.
When ordering selected transistors please quote circuit reference.

* Quieting control anticlockwise.

† Stereo Indicator may light when measuring base volts.

COILS AND TRANSFORMERS			Part number	Circuit ref.	DC resistance ohms		425 & 426	525 & 526
Part number	Circuit ref.	DC resistance ohms						
RFC1	L1	.75	MAINS TRANSFORMER	L43	1.6		P1 0.1A 12V	0.1A 6.5V }
RFC2	L2	.75		L44	11		P2 0.1A 12V	0.1A 6.5V }
FTA4	L3	.2		L45	11		P3 0.1A 12V	0.1A 12V
	L4	.1		L46	0.6 (centre tapped)		P4 0.05A 10V	0.05A 50V
RFC3	L5	—		L47	60			
FRO1	L6	—		L48	60			
FRO1	L7	—						
FRO1	L8	—						
RFC2	L9	—						
IFT24	L10	1.3						
	L11	.3						
IFT20	L12	.3						
	L13	.3						
IFT20	L14	.3						
	L15	.3						
IFT20	L16	.3						
	L17	.3						
	L18	.5						
RDT3	L19	—						
	L20	.65						
ED1	L22	90 (tapped at 3.2 ohms)						
ED1	L23	90 (tapped at 3.2 ohms)						
ED2	L24	23 (tapped at 2.5 ohms)						
	L25	.9 (centre tapped)						
IFR	L26	—						
	L27	3.5						
MLA1	L28	33						
	L28a	1.8						
	L29	2.6						
MLR1	L30	3.7						
	L31	34						
	L32	1.4						
	L33	2.3						
ML01	L34	6.4						
	L35	0.5						
	L36	10.5						
IFT21	L37	4.5						
	L38	4.5						
IFT21	L39	4.5						
	L40	4.5						
IFT22	L41	6.4						
	L42	*						

DIODES		
D1-D7 inclusive	OA79 or AA119	
D8 Zener Diode	LMX12A or IN4164	
D9-D13 inclusive	DD003 or PL4003	
D14 Zener diode	LMZX12A or IN4164	
D15 and 16	DD003 or PL4003	

POTENTIOMETERS		
VR1	50K LIN (FM quieting)	
VH2	1K pre-set (adjust meter)	
VR3	100K-100K LIN (bass)	
VR4	100K-100K LIN (treble)	
VR5	20K 95%-20K 5% (balance)	
VR6	100K-100K S/LOG (volume)	
VR7	8.2K pre-set	
VR8	1K pre-set (adjust HT volts)	
VR9	1K LIN pre-set (output level)	

FUSES		
F1	1A (20 mm×5 mm)	
F2	1A (20 mm×5 mm)	
F3	400 mA anti-surge (20 mm×5 mm)	
	(800 mA for 105-125V AC input)	
F4	100 mA anti-surge (20 mm×5 mm)	

PILOT LAMPS		
(200 mA for 105-125V AC input)		
	423 & 424	523 & 524
P1	12V 0.1A MES	6.5V 1W LES
P2	12V 0.1A MES	6.5V 1W LES
P3	12V 0.1A MES	12V 1.5W LES
P4	10V 0.05A MES	10V 0.05A MES

* 100 ohms, positive of meter to earth 100K, negative of meter to earth (D7 is inside can).

RESISTORS & CAPACITORS

Circuit		Circuit		Circuit		Circuit		Circuit		Circuit		Circuit	
Ref.	Value	Ref.	Value	Ref.	Value	Ref.	Value	Ref.	Value	Ref.	Value	Ref.	Value
48	18K	98	5-6K	148	180K	198	56K	248	100mfd	282	47 ohm	1278	18K
49	0-01mfd	99	22K	149	1K	199	150K	249	10mfd	283	47 ohm	1279	750 ohm
50	1K	100	27K	150	0-1mfd	200	4-7K	250	4-7K	284	0-82 ohm	1280	Cz 10
51	0-01mfd	101	12K	151	1K	201	25mfd	251	4-7K	285	0-82 ohm	1281	18K
52	100 ohm	102	1K	152	68pf	202	470K	252	47K	286	1250mfd	1282	51 ohm
53	200pf	103	0-22mfd	153	20pf	203	100 ohm	253	0-1mfd	287	10 ohm	1283	51 ohm
54	68pf	104	15K	154	320pf	204	100K	254	4-7K	288	0-1mfd	1284	0-47 ohm
55	200pf	105	0-1mfd	155	100 ohm	205	10K	255	250pf	289	1-5K	1285	0-47 ohm
56	68K	106	450pf	156	0-1mfd	206	100mfd	256	6-8K	290	0-0022mfd	1287	22 ohm
57	0-1mfd	107	1K	157	10K	207	100K	257	5mfd	291	1-2K ohm	1288	8-2K
58	47pf	108	100mfd	158	820 ohm	208	27K	258	47K	292	1250mfd	1289	0-0015 mfd
59	15K	109	3-9K	159	0-1mfd	209	270 ohm	259	450pf	293	270 ohm		
60	0-1mfd	110	6-8K	160	56K	210	25mfd	260	25mfd	294	1K	1290	1-5K
61	10K	111	6-8K	161	560 ohm	211	25mfd	261	100K	295	0-1mfd		
62	0-01mfd	112	5-6K	162	390pf	212	68K	262	100K	296	3-9K		
63	2-7K	113	0-22mfd	163	220pf	213	6-8K	263	68K	297	220 ohm		
64	0-01mfd	114	5-6K	164	25mfd	214	18K	264	33 ohm	298	2-7 ohm		
65	680 pf	115	5-6K	165	0-1mfd	215	2-7K	265	320mfd	299	2-7K ohm		
66	0-01mfd	116	0-22mfd	166	47K	216	25mfd	266	1-5K	300	1500mfd		
67	270 ohm	117	5-6K	167	88pf	217	25mfd	267	68pf	301	0-1mfd		
68	100 ohm	118	6-8K	168	20pf	218	0-22mfd	268	2-7K	302	50mfd		
69	50pf	119	560pf	169	320pf	219	10mfd	269	50mfd	303	220 ohms		
70	68pf	120	560pf	170	400pf	220	270 ohm	270	1K	304	0-1mfd		
71	22-5pf	121	4-7K	171	400pf	221	5-6K	271	1K	305	250pf		
72	50pf	122	1500pf	172	180K	222	0-015mfd	272	390 ohm	306	0-1mfd		
73	1K	123	1500pf	173	33K	223	12K	273	1250mfd	307	220pf		
74	27K	124	4-7K	174	1mfd	224	0-0068mfd	274	*10mfd	C22 & C27 only : 304 47K 305 470K 306 25mfd 307 470 ohms 1256 6-8K 1257 0-1mfd 1260 25mfd 1261 33 ohm 1262 100K 1263 100K 1264 22 ohm 1265 2200pf 1266 8-2K 1267 2200pf 1268 2-7K 1269 50mfd 1270 1K 1271 1K 1272 390 ohm 1274 10mfd 1275 10mfd 1276 Cz 10 1277 750 ohm			
75	27K	125	560pf	175	0-1mfd	225	1-5K	275	*10mfd				
76	68pf	126	6-8K	176	27K	226	0-0033mfd	276	*VA 1098				
77	2700pf	127	560pf	177	1K	227	4-7K	277	*510 ohm				
78	4-7K	128	1000pf	178	0-1mfd	228	0-047mfd	278	*22K				
79	0-1mfd	129	1000pf	179	1K	229	0-047mfd	279	*510 ohm				
80	1K	130	47 ohms	180	400pf	230	8-2K	280	*VA 1098				
81	10mfd	131	5-6K	181	400pf	231	8-2K	281	*22K				
82	12K	132	0-01mfd	182	68K	232	0-01mfd			1256	6-8K		
83	0-1mfd	133	0-1mfd	183	0-1mfd	233	8-2K			1257	0-1mfd		
84	100mfd	134	1500pf	184	15K	234	270K			1260	25mfd		
85	2-2K	135	5-6M ohm	185	0-1mfd	235	2200pf	*On some early models the VA 1047 thermistor was used instead of the VA 1098. In these cases 39K resistors were used instead of 22K, 1K instead of 510 ohms and 5mfd capacitor instead of 10mfd.				1261	33 ohm
86	27K	136	5-6M ohm	186	1K	236	0-015mfd					1262	100K
87	400pf	137	450pf	187	400pf	237	2200pf					1263	100K
88	30pf	138	15K	188	270 ohm	238	0-02mfd					1264	22 ohm
89	5mfd	139	2200pf	189	10K	239	4-7K					1265	2200pf
90	56K	140	4700pf	190	0-1mfd	240	5-6K					1266	8-2K
91	18K	141	68pf	191	0-001mfd	241	3-9K					1267	2200pf
92	1K	142	320pf	192	10K	242	25mfd					1268	2-7K
93	100mfd	143	20pf	193	3-9K	243	25mfd					1269	50mfd
94	10K	144	10mfd	194	220K	244	68K					1270	1K
95	450pf	145	47K	195	2-2M ohm	245	18K					1271	1K
96	0-1mfd	146	0-1mfd	196	0-001mfd	246	1M ohm					1272	390 ohm
97	0-047mfd	147	560 ohm	197	0-01mfd	247	3-9K					1274	10mfd

Alignment

The method of alignment described below will locate most faults that affect alignment. Alignment should not be attempted without proper equipment.

FM IF ALIGNMENT

- 1 Connect oscilloscope to junction of R75, C77. Set oscilloscope to 10 milli-volts per cm.
- 2 Connect sweep generator via 0.01 mfd to base of TR7. Set generator to 10.7 MHz. Unwind bottom tuning slugs on all FM IFT's so that the bottom of the slugs are level with the printed circuit board.
- 3 Adjust L20, L18 for normal discriminator response with peak to peak of 500 kHz centred on 10.7 MHz.
- 4 Transfer generator to base of TR5. Reduce output from generator. Unwind bottom slug of L20 until bottom of slug is level with printed circuit board. Adjust L16, L17 for maximum output, this will show a broad top with -3dB points at 10.5 and 11 MHz.
- 5 Transfer generator to base of TR4. Adjust L14, L15 for maximum output. Reduce output of generator as alignment proceeds. This will give a flat top response (perhaps a slight dip in centre) with -3dB points at 10.5 and 10.9 MHz.
- 6 Transfer generator to base of TR3. Increase output from generator. Adjust L12, L13 for maximum output. (Earth lead of generator must be connected close to TR3). This will give similar response to step 5 but with -3dB points at 10.6 and 10.8 MHz.
- 7 Transfer generator to base of TR2. Adjust L10, L11 for maximum output. Response should be as 6.

- 8 Leave generator on base of TR2. Adjust L20 for normal discriminator response. Recheck L10 for maximum output. With oscilloscope set for 100 mV/cm check that discriminator response is linear and with a peak to peak to 400 kHz minimum centred on 10.7 MHz.

Note:

Never readjust any slugs after moving on to next step of alignment. It may be that spurious signals show on the oscilloscope during alignment. A very short wire shorting out the FM oscillator section of the gang will prevent this.

FM RF and OSCILLATOR ALIGNMENT

- 9 Check that dial log scale reads 0 when gang is fully in mesh.
 - 10 Transfer generator to coax aerial socket, and adjust generator for 22.5 kHz deviation at 88 MHz with 1 kHz modulation. Tune receiver to 88 MHz on dial. Adjust L8, L6, L7 in that order for maximum output. Keep generator input below that at which limiting starts.
 - 11 Tune generator and receiver to 108 MHz. Adjust C22, C14, C11 in that order for maximum output.
 - 12 Repeat 10 and 11 until no further improvement in sensitivity and/or tracking results. The FM alignment is now complete.
- Note:
If realigning, unwind all slugs before starting.

AM IF ALIGNMENT

- 1 Connect oscilloscope or valve voltmeter to junction of C197 and S10.
- 2 Connect generator to centre section of AM gang and earth. Tune generator to 430 kHz with 30% modulation at 400 Hz.
- 3 Adjust L41, L40, L39, L38, L37 in that order for maximum output. Repeat adjustments until there is no further increase in output. It is very important that the generator output be as low as possible.

MEDIUM WAVE RF AND OSCILLATOR ALIGNMENT

- 4 Transfer generator to AM aerial input. Switch receiver to MW and tune to 550 metres. Leave generator set to 430 kHz. Adjust L26 for minimum output.

- 5 Set generator to 550 metres. Adjust L34, L30, L27 in that order for maximum output.
- 6 Set generator to 200 metres. Tune receiver to 200 metres. Adjust C168, C153, C143 in that order for maximum output.
- 7 Repeat steps 5 and 6 until no further increase in output or improvement in tracking results.

LONG WAVE RF AND OSCILLATOR ALIGNMENT

- 8 Set generator to 1500 metres. Switch receiver to LW and tune to 1500 metres. Adjust L36, L31, L28 in that order for maximum output.
- Note:
There are no trimmers on LW.
The AM alignment is now complete.
- Note:
If realigning, unwind all slugs before starting.

ALIGNMENT OF M8 STEREO DECODER

A Stereo Signal Generator must be used and be capable of providing:

- 1 A modulated signal between 88-108 MHz (a single spot frequency will do).
- 2 Pilot only.
- 3 A+B.
- 4 A or B at 1 kHz.
- 5 A-B.

- 1 Connect the generator to the FM aerial input of the Tuner or Tuner-Amplifier. Switch Tuner to FM stereo. Set signal generator for 100 micro-volts output, modulated by pilot only. (19 kHz, 9% modulation). Set tuner carefully to generator frequency. Connect oscilloscope to collector of TR10 on Decoder, with oscilloscope sensitivity set to 1V per cm.
- 2 Tune L23, L24 for maximum output. Signal should reach 2 to 3 volts peak to peak at 19 kHz.
- 3 Transfer Y input of oscilloscope to junction of C87 and C89. Set oscilloscope sensitivity for 10 millivolts per cm. Switch time base off and connect X amplifier to collector of TR10 via 500 pf capacitor. Set X amplifier for 1V per cm.

- 4 A figure of eight should now appear on the oscilloscope similar to Fig. 1. L23 should be adjusted carefully slightly clockwise for an exact centre crossover point as in Fig. 2.



Fig. 1

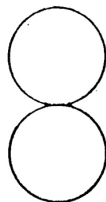


Fig. 2

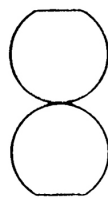


Fig. 3

Decoder Alignment

Note:

A flat top or bottom to the eight is unimportant. For example see Fig. 3.

- 9 Switch to A only, then B only (with pilot on). The respective channels should show the same output as before. Cross Talk should be at least 25 dB down. The actual figure will generally be better than this but will depend on correct alignment of the tuner and decoder. Alignment is now completed.

Note:

If a 67 kHz storecast filter is fitted as in some export models, this should be tuned for *minimum* output with a modulated signal of 67 kHz, 10% modulation depth via the normal stereo generator SCA socket.

- 5 Disconnect oscilloscope. At this stage the stereo pilot lamp fitted to the tuner should be alight and remain alight when the pilot level is reduced to at least 7%.
- 6 Connect a suitable output meter to the audio output of the tuner (or tape recording output on tuner-amplifier). Set sensitivity for approximately 1 volt. In case of tuners, check that pre-set output controls are at maximum.
- 7 Set stereo generator for A+B (at a modulation level of 35% at 1 kHz *with pilot switched off*). With pilot switched on, the combined levels should be 44%. Leave pilot on! The output meter should read approximately 400 millivolts each channel. Channel matching should be ± 1 dB.
- 8 Switch modulation to A-B. Output meter should remain the same as for A+B.

Specifications

AMPLIFIER AND CONTROL UNIT

RMS Power Output	25 watts per channel into 8 ohms
Power response	25 watts, 20-20,000 Hz
Frequency response	20-20,000 Hz ± 1 dB
Harmonic distortion	Less than 0.5% measured at 25 watts output ± 1 dB
Crosstalk	Better than 40 dB
Channel matching	± 1 dB
Bass control	± 10 dB at 70 Hz
Treble control	± 10 dB at 10 kHz
Balance control	Maximum to zero each channel
Rumble filter	-5 dB at 30 Hz increasing at lower frequencies.
Treble filters	1.6.5 kHz-3 dB, 10 kHz-25 dB 2.4.5 kHz-3 dB, 9 kHz-40 dB
Loudness	At 1 kHz reference (-20 dB), 70 Hz ± 10 dB, 10 kHz ± 5 dB
Tape recording output	400 mV Low impedance
Headphone output	Suitable for all stereo phones
Inputs	Sensitivity Hum and Noise (reference 25 W) -70 dB -55 dB -55 dB
Tape playback	400 mV
Pickup 1. Creamic	60 mV
Pickup 2. Magnetic	3.5 mV

FM TUNER SECTION

Coverage	86-109 mHz
Sensitivity	Mono $1.5\mu V$ } for 30 dB signal to noise ratio at 75 KHz Stereo $5\mu V$ } deviation.
Intermediate frequency	10.7 mHz
IF bandwidth	220 kHz at 6 dB down
IF rejection	80 dB
Aerial inputs	70-80 ohms and 300 ohms

AM TUNER SECTION

Coverage	Medium waveband 185-590 metres; 510-1,625 kHz Long waveband 1,000-2,000 metres; 150-300 kHz
Sensitivity	5 μV for 20 dB signal to noise ratio
Intermediate frequency	430 kHz
IF bandwidth	4 kHz at 6 dB down
IF rejection	80 dB

STEREO RADIO DECODER M8 & M4

Frequency response	30-15,000 Hz ± 1 dB
Channel separation	30 dB at 1 kHz
Hum and noise	-60 dB
Filters	38 kHz each channel
Suppression	38 kHz
De-emphasis	40 dB 50 μ /secs (European) 75 μ /secs (N. America)

POWER SUPPLIES AMPLIFIERS & TUNER AMPLIFIERS

AC voltage	All models 105-125, 210-250; 50-60 Hz
Maximum power consumption	72 watts

AUDIO OUTPUT—TUNERS

Output voltage	Variable 0-1 volt
Impedance	Low matching all amplifiers

TUNER POWER SUPPLIES

AC voltage	105-125, 210-250; 50-60 Hz
Maximum power consumption	15 watts