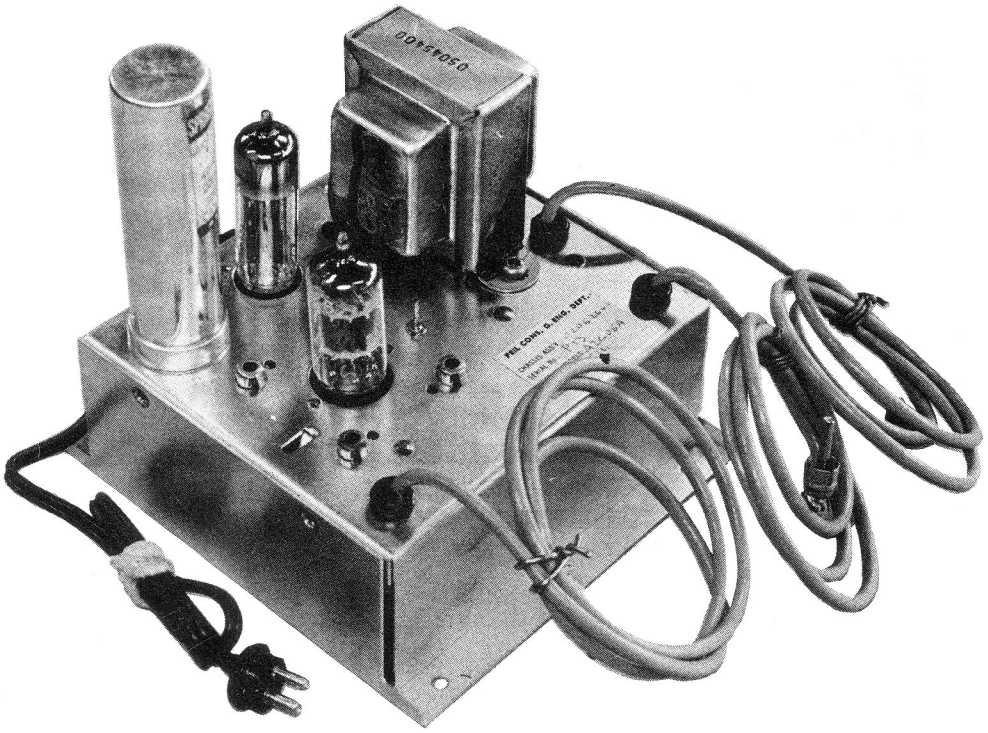
SERVICE DATA

PHILIPS FM-STEREO ADAPTOR MODEL A2C05A



SPECIFICATIONS

LINE Voltage	117 Volts
LINE Frequency	60 cps
Current Consumption	0.1 amperes
Rated Input	2.5V RMS at 1000 cps (0.3V RMS PILOT carrier)
Rated Output	2.0V RMS
Frequency Response	80-10,000 cps within ±2 db
Channel Separation	25 db minimum at 1000 cps
Hum and Noise Output	68 db below rated output
Residual 38 Kc Output	40 db below rated output

PHILIPS • ROGERS MAJESTIC

PHILIPS ELECTRONICS INDUSTRIES LTD.

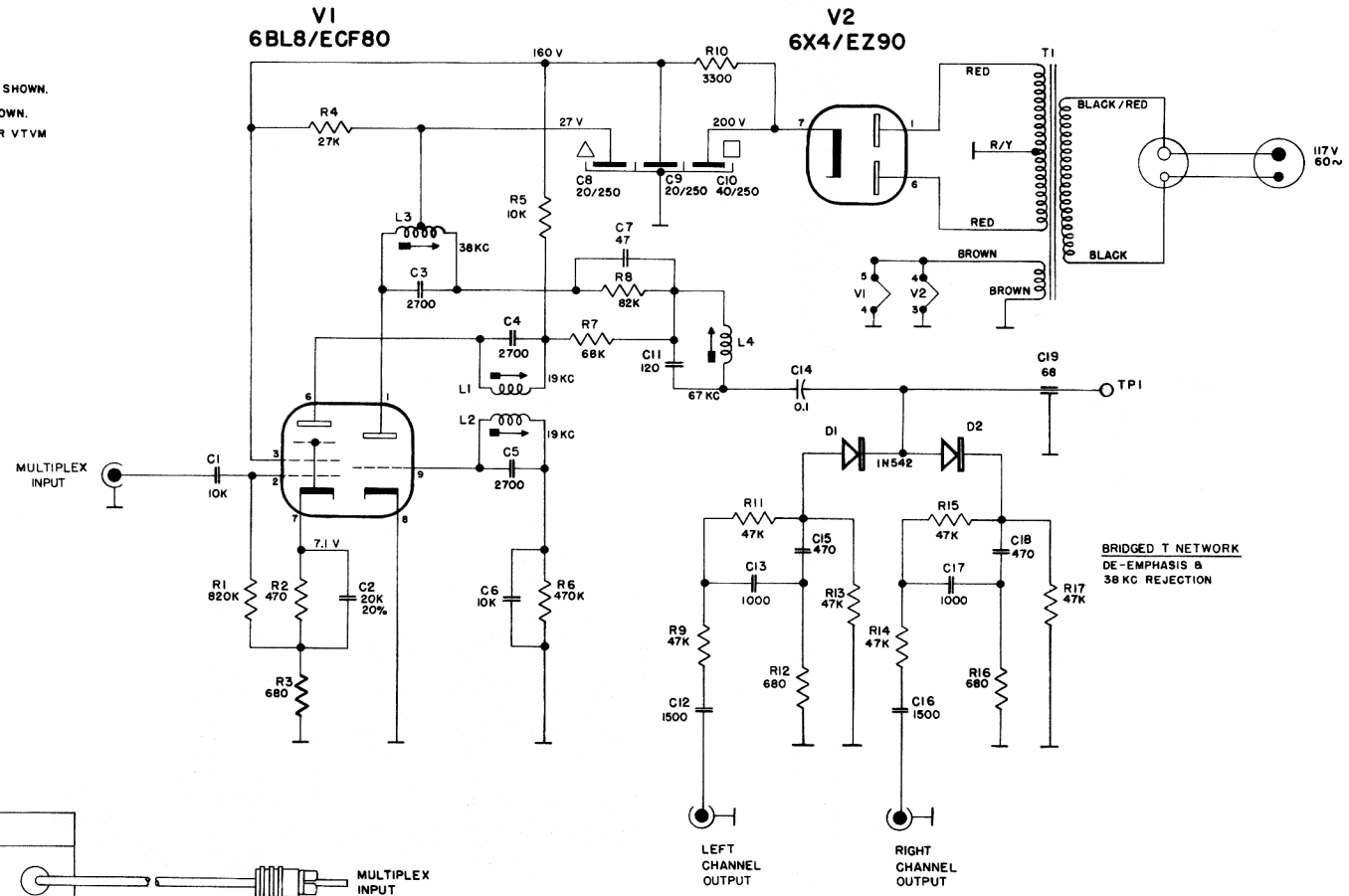
HALIFAX • MONTREAL • WINNIPEG
EDMONTON • VANCOUVER • TORONTO

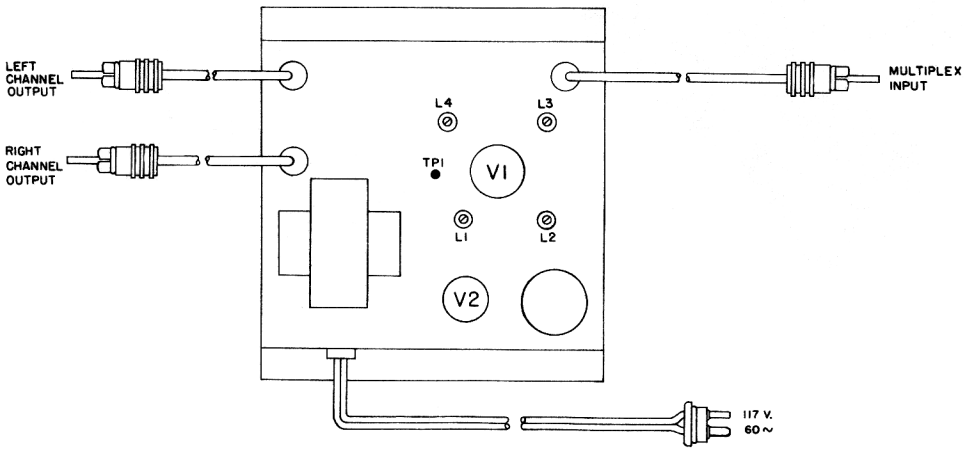
HF. 5001-1-62.

NOTES: SUFFIX "K" = 1000 MEG = 1,000,000
RESISTORS ARE 1/2 WATT ± 10% UNLESS OTHERWISE SHOWN.
—||— VALUES IN MICROMICROFARADS ±10%, 200V UNLESS OTHERWISE SHOWN.
—||— VALUES IN MICROFARADS ± 10%, 400V UNLESS OTHERWISE SHOWN.
D C VOLTAGES MEASURED TO CHASSIS WITH A 20,000 Ω/V METER OR VTVM
NO SIGNAL APPLIED, LINE VOLTAGE 117 V 60 ~
PLUGS & SOCKETS VIEWED FROM PIN SIDE.

TUBE FUNCTIONS:

V1 AMPLIFIER & DOUBLER
V2 RECTIFIER





SCHEMATIC DIAGRAM
MODEL A2C05A
FM-STEREO ADAPTOR

A2C05A
FM STEREO ADAPTOR

PRINCIPLE OF FM-STEREO

THE COMPOSITE SIGNAL

The composite signal is used to frequency modulate a (single) carrier. When received by an FM Tuner, the composite signal will be available at the output of the FM detector (ratio-detector or discriminator).

In the composite signal, the Left and Right channels are encoded in a manner that provides a balanced monophonic output from monaural FM receivers (compatibility) and a complete stereophonic output from FM stereo-decoders.

The mathematical form of a composite signal conforming to DOT (Canada) and FCC (USA) requirements, is as follows:

$$M(t) = (L+R) + (L-R)\cos wt + P\cos\frac{W}{2}t$$

where $M(t)$ = composite signal
L = Left channel audio
R = Right channel audio
P = Pilot carrier amplitude
W = $2\pi f$ where f = 38 Kc.

(L + R) represents the sum of the Left and the Right channels and therefore is also called the MONOPHONIC signal. An FM receiver not equipped for stereo will reproduce the MONOPHONIC signal only.

(L - R) cos w t represents the difference between the Left and the Right channels modulated onto a suppressed 38 Kc. carrier and since it can exist only when Left and Right channels differ (stereo) it is also called the STEREOPHONIC signal.

$P\cos\frac{w}{2}t$ is the 19 Kc. pilot carrier which is exactly 1/2 the frequency of the 38 Kc. sub-carrier. The 19 Kc. pilot carrier is necessary since it serves at the receiver end to recover the suppressed 38 Kc. sub-carrier. It can also be considered as synchronizing information for the correct decoding of the composite signal.

The frequency spectrum and relative amplitudes of the composite signal are shown in Fig. 1.

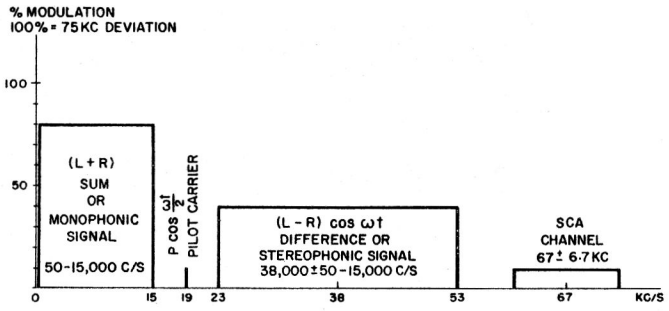


FIG. 1
FREQUENCY SPECTRUM OF THE COMPOSITE SIGNAL

The "Sub-carrier authorization" (SCA) channel is used for the transmission of subscription music (storecasting) and is not considered a part of the composite stereo signal. Its use by the broadcaster is optional.

MAXIMUM PERMISSIBLE MODULATION

Figure 1, also shows the modulation percentage permitted by DOT and FCC regulations, which are as follows:

Maximum modulation of carrier = ± 75 Kc.

MONOPHONIC signal	=	up to 80% (90% where SCA is not used) of the maximum modulation.
STEREOPHONIC signal	=	up to 80% with both side-bands at 40% with each side-band (90% and 45% respectively where SCA is not used) of the maximum modulation.
19 Kc. Pilot carrier	=	10% (constant) of the maximum modulation.
SCA carrier	=	10% (FM modulated 6.7 Kc.) of the maximum modulation.

INTERLEAVING ACTION

It should be noted that both the MONOPHONIC and the STEREOPHONIC signals may modulate up to 80% each and yet not exceed the permissible 80% maximum. This is because one signal can have maximum amplitude only when the other is at minimum - and vice-versa. This is known as the "Interleaving Action".

From the foregoing brief description of the composite signal, it will be realized that the FM tuner must have a flat response or detection characteristic up to at least 53 Kcs. if the full composite signal (excluding the SCA channel) is to be recovered. This condition is fulfilled by all Philips and Rogers Majestic equipment, designed for the reception of stereo FM.

ENCODING AND DECODING THE COMPOSITE SIGNAL

Various methods of encoding and decoding the composite signal may be used such as switching, matrixing, envelope detection or combinations of one or the other. The Philips FM-STEREO Adaptor A2C05A uses the switching method to make alternate connections to the Left and Right channel at a supersonic rate (38 Kc.), thus multiplexing two signals into one, i.e., the composite signal.

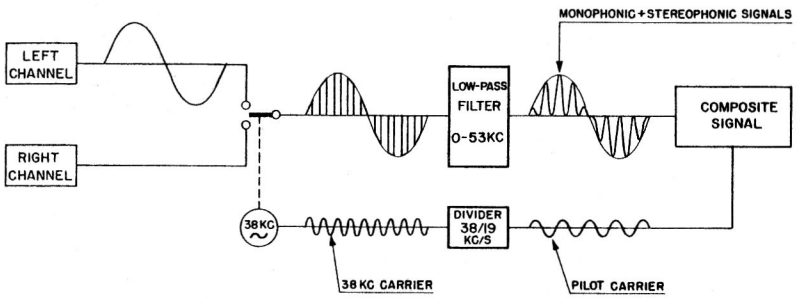


FIG. 2

ENCODING OR DECODING OF THE COMPOSITE SIGNAL

Figure 2, shows a Left channel (only) signal after encoding and how this encoded signal is derived. The square waves (38 Kc. repetition rate) filling the Left channel are changed into sinewaves of the same frequency after higher harmonics of the switching rate (38 Kc. carrier) are filtered out. The diagram shows a mechanical switching device to simplify the reader's interpretation of this method of encoding, in reality an electronic switch is used. A Right channel (only) signal can also be encoded in a similar manner as can any combination of Left and Right channel signals. This encoding process is also reversible and can be used to reproduce the Left and Right channel signals for any given composite signal.

CIRCUIT DESCRIPTION. FM-STEREO ADAPTOR A2C05A

The composite signal from the FM Tuner is connected to the MULTIPLEX INPUT jack and is coupled to the grid of V1 via C1. After amplification by V1 it appears across the plate load resistor R5. It is fed via R7 and the 67 Kc. trap to the electronic switch D1 and D2.

The 19 Kc. Pilot carrier signal is selected from the amplified composite signal by the tuned circuit of L1 and L4 and is inductively coupled into the tuned circuit of L2 and C5, both of these circuits form a 19 Kc. band-pass filter.

The 19 Kc. Pilot carrier is then amplified and frequency-doubled in the triode section of V1, the tank circuit of which (L3 and C3) is tuned to 38 Kc.

This regenerated 38 Kc. sub-carrier is then used to actuate the electronic switch D1 and D2; it is fed via the phase shifting network C7 and R8.

The 38 Kc. sub-carrier must be inserted in its correct phase relationship or separation of the Left and Right channel signals, necessary for proper stereo reproduction, will not be obtained. The phase relationship is quite critical.

After proper separation by the electronic switch D1 and D2, each channel signal is fed through a combined de-emphasis and 38 Kc. rejection circuit to avoid possible overloading and subsequent distortion in the amplifier(s) of the associated HI-FI equipment and/or interference to tape recorders.

If a MONOPHONIC transmission (i.e. without pilot carrier) is received, no switching or separation by D1 and D2 can occur since their function depends upon alternate biasing by the regenerated, synchronous and in phase 38 Kc. sub-carrier. In this event, the signals appearing at the Left channel and Right channel outputs will be severely distorted. Thus, the Adaptor A2C05A will only provide satisfactory outputs from a STEREO FM or MONOPHONIC programme originating from a broadcasting station transmitting a composite signal.

ALIGNMENT USING SIGNAL GENERATORS (Preferred Method)

Connect an AC. VTVM to TP 1 and ground.
Apply 67 Kc. ± 100 cps. (0.3V RMS) to the MULTIPLEX INPUT jack.
Adjust L4 for minimum indication on the VTVM (16 to 40 millivolts).
Remove the 67 Kc. signal source and apply 19 Kc. ± 2 cps. (0.3V RMS) to the MULTIPLEX INPUT jack.
Adjust in the following order: L1, L2, L3 for maximum indication on the VTVM (5.0 to 7.0 VAC)

Since the peak or maximum is purposely rather broad, repeat the adjustment and observe even the slightest needle movement.

NOTE: Correct "peak" alignment ensures proper phasing of the regenerated 38 Kc. carrier - incorrect "peak" alignment will result in loss of channel separation.

ALIGNMENT USING STEREO-FM STATION SIGNAL

Connect AC VTVM to TP1 and ground.
Connect MULTIPLEX INPUT to the MULTIPLEX OUTPUT of a Philips or Rogers Majestic FM Tuner or other suitable equipment.
Tune in a composite signal which can be received with a signal strength of at least 100 microvolts at the antenna terminals.
Adjust in the following order L1, L2, L3 for maximum indication on the VTVM. (3.5 to 7.0 VAC).
Repeat this adjustment carefully since programme modulation tends to obscure the VTVM indication (unsteady needle movement). Accurate results will be obtained during a moment of no programme modulation from the broadcasting station.

The 67 Kc. trap may be aligned, if the broadcasting station is transmitting an SCA carrier, as follows:

Adjust L4 for minimum audible interference which sounds somewhat similar to the output from a tape recorder which is playing back information faster than it was recorded.

NOTE: This alignment procedure will give satisfactory results - approximately 20 db. or better, channel separation.
When replacing resistors or capacitors, the specified tolerances (± 10%) should not be exceeded. Tube replacement will not cause misalignment.

LIST OF SPECIAL PARTS

Ref. No.		
T1	Transformer	05045400
C8, C9, C10	Capacitor 40+20+20 MF/250V	51651500
C2	Capacitor Cer Disc 20 K μμF	51420303
C19	Capacitor Feed-through 68 μμF	51801900
L1 & C4, L2 & C5	Coil Assy. 19 Kcs.	07044500
L3 & C3	Coil Assy. 38 Kcs.	07044600
L4 & C11	Coil Assy. 67 Kcs.	07044700
D1 & D2	DIODES (matched pair) 1N542	642-098