DROITWICH MONITORING RECEIVER RC3/7

Introduction

The RC3/7 receives the 200-kHz Droitwich transmission and provides a 1-MHz output to lock the internal oscillator of an associated frequency monitor[1].

The receiver comprises an Airmec Type 379A Droitwich Receiver and Harmonic Generator, a preamplifier to match the receiver to a whip aerial, and a mains-driven power supply

The RC3/7 is constructed on a CH1/12A chassis with a rear-panel mounted aerial connector PO No 1 (Musa) plug. The front panel carries an output-monitoring socket *O/P MON 50 mV*. Index coding-pegs are not required.

General Specification

Signal Input

Frequency	200 kHz
Sensitivity	<100 μV for 3 V output at 1 MHz
Impedance	matches 4-foot whip aerial with up to 200-pF lead capacitance

Signal Output

Frequency	1 MHz
Amplitude	>3 V p-p
Impedance	about 150 ohms
Load resistance	>1·5 kilohms
Frequency stability	as Droitwich (better than 2 parts in 10^{11}, long term, not allowing for modulation and propagation effects)
Residual modulation	less than 1% for 80% input modulation

Receiver Gain	90 dB
Power Input	240 V a.c., 1 W, fused at 150 mA
Temperature Range	0°C to 40°C ambient
Weight	1 kg

Circuit Description

Fig. 1 is a circuit diagram of the complete receiver.

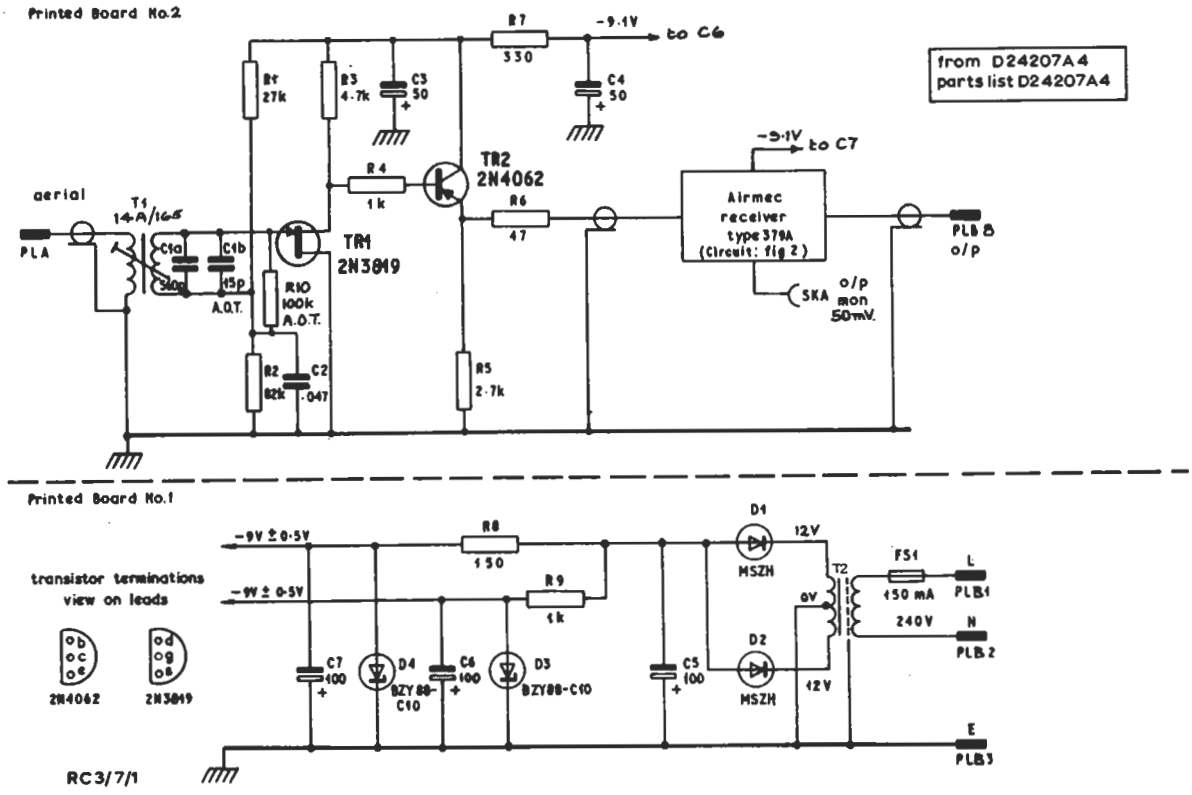


Fig. 1. Circuit Diagram of the RC3/7

Fig. 2 gives the circuit of the Airmec Type 379A Receiver.

Aerial Pre-amplifier

T1 is 1:5 voltage step-up transformer with a secondary tuned to 200 kHz and damped (to ensure overall stability) by R10. The source follower TR1 and emitter follower TR2 together provide a current gain of about 40 dB.

Airmec Type 379A Receiver

The pre-amplifier TR1 drives VT8, which feeds a tuned circuit in the base of a two-stage aperiodic amplifier VT1, VT2. The output of the aperiodic amplifier drives a further transistor stage VT3, with a 200-kHz tuned circuit in its collector.

The 200-kHz output from the amplifier feeds a delayed agc detector MR3. The agc voltage is applied to the second stage of the aperiodic amplifier via an emitter follower buffer VT4, and ensures an almost constant output level for varying receiver input levels in the range 100 μV to 1 V with 80% modulation.

The 200-kHz output from the amplifiers also feeds a transistor limiter VT5 giving a square-wave output which removes any amplitude modulation appearing on the signal. The output from the limiter drives a tuned circuit providing a 200-kHz sinewave at the base of the class-C amplifier VT6.

The class-C transistor stage amplifies the fifth harmonic of the 200-kHz signal to obtain a 1-MHz sinewave, which is then applied to the emitter follower output stage VT7. The synchronising signal is taken from VT7 emitter, and the monitoring signal is developed across R32 in VT7 collector feed.

Power Supplier

A bi-phase rectifier circuit drives two 9-V zener-diode regulators which provide separate supplies at −9·1 V to the pre-amplifier and Airmec Receiver, respectively.

Installation

The RC3/7 is aligned on Production Test, using the procedure given below, with a dummy aerial (circuit shown in Fig. 3). To maintain this alignment the installed aerial should be a 4-foot whip with a down-lead capacitance not exceeding 200 pF.

The Musa connector on the down-lead must not make contact with the receiver output earth, or instability may result.

Alignment

This is not a routine alignment and should not be treated as such. It is given as a guide to correct alignment after a coil or tuning capacitor has been replaced.

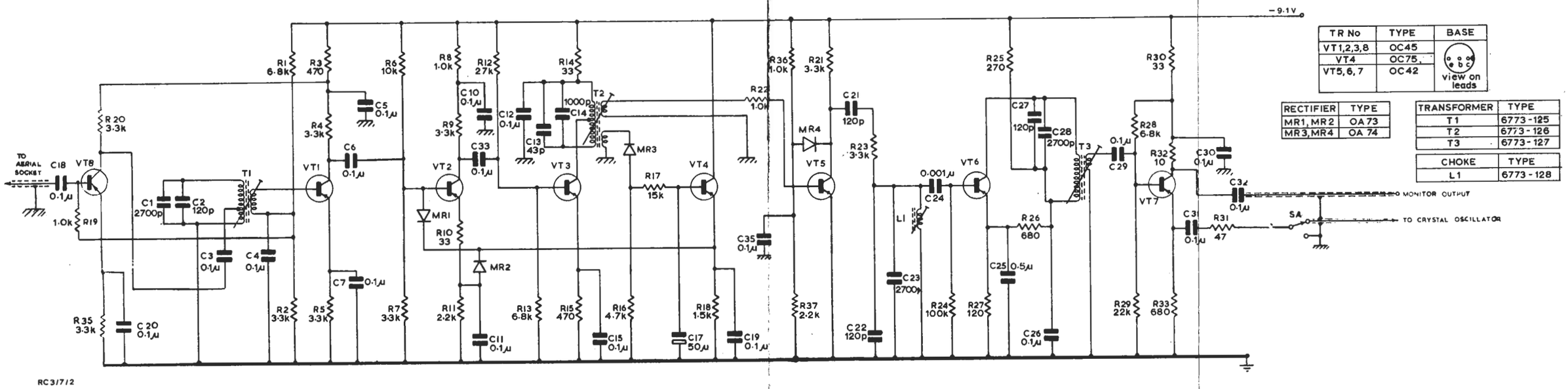
Equipment

Oscillator capable of supplying 200 kHz ± 200 Hz at 1 V p-p into 75 ohms (e.g. Wayne Kerr Type 022D)
Frequency Counter capable of measuring 200 kHz to 1 part in 10^5 (75-ohm input)
75-ohm Attenuator capable of attenuating the oscillator output by 130 dB with a resolution of 1 dB
Dummy Aerial as shown in Fig. 3
Oscilloscope (Tektronix 515 or equivalent)
X10 High-impedance Probe
Avo 8
Trimming Tool (Neosid TT1)
Trimming Tool (Mullard Type 2047)
PN3A/2 connected thus and with holes drilled to give access to the aerial connector:

1 Live
2 Neutral
3 Earth (Mains)
8 Receiver Output
6 or 10 Receiver Output Earth

Procedure

1. Temporarily solder a 47-kilohm resistor across C1b in the pre-amplifier. If R10 (100 kilohms AOT) is present, remove it.
2. Connect the receiver to the mains via the Painton socket and switch on. Use the Avo 8 to check that the voltage at the junction of R9 and D3 (on the power supply board) is −9 ± 0·5 V w.r.t. chassis and that the voltage at the junction of R8 and D4 is also −9 ± 0·5 V w.r.t. chassis.
3. Use the frequency counter to adjust the oscillator frequency to 200 kHz ± 200 Hz and inject this signal via the attenuator into the receiver input. Align the oscilloscope probe and use it to monitor the receiver input voltage. Adjust the attenuator to give 0·5 V p-p at the input. Transfer the probe to the pre-amplifier output pin; (next to R6 on the pre-amplifier board). This voltage should be 0·75 V p-p and there should be no clipping of the output signal.
4. Connect the receiver output via a screened lead to the unterminated oscilloscope input. Inject the 200-kHz signal at about −20 dB into the receiver input.
   Monitor the output signal (1 MHz); the amplitude should be greater than 3 V p-p. Attenuate the input signal until the output amplitude drops to about 2 V p-p mean amplitude. (The signal will probably have a broken-up, noisy appearance; this is normal.)
5. Through the holes in the base-plate of the Airmec receiver, slightly adjust coils 1, 2, 3, 4 in this order (see Fig. 4) for maximum output and



TR No	TYPE	BASE
VT1,2,3,8	OC45	view on leads
VT4	OC75	
VT5,6,7	OC42	

RECTIFIER	TYPE
MR1, MR2	OA 73
MR3, MR4	OA 74

TRANSFORMER	TYPE
T1	6773-125
T2	6773-126
T3	6773-127

CHOKE	TYPE
L1	6773-128

Fig. 2. Circuit Diagram of the Airmec Receiver Type 379A

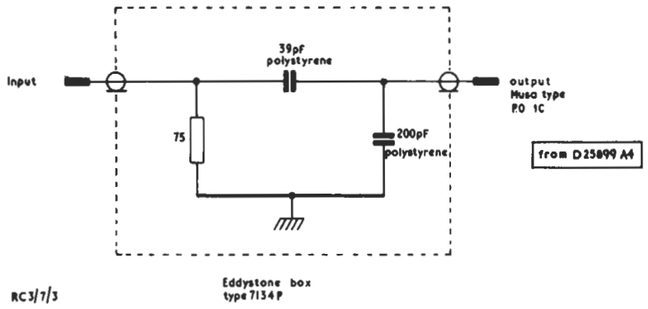


Fig. 3. Circuit of the Dummy Aerial

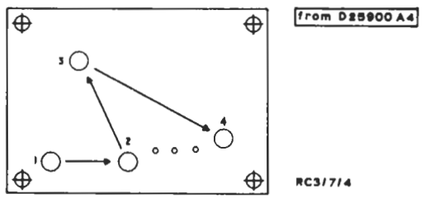


Fig. 4. Coil Adjustment in the Airmec Receiver

minimum signal break-up. During this process progressively attenuate the input to maintain a mean output amplitude of 2 V p-p.

Take care not to screw the cores too far and not to lock the cores by bottoming them in the coils. The tuning peak of coil 1 is very flat.

6. Remove the 200-kHz input signal and unsolder the 47-kilohm resistor. Connect the 200-kHz signal to the dummy aerial input and connect the output to the receiver input with a Musa lead not longer than 1 foot.
7. Set the oscillator level to give 2 V p-p at the receiver output. Set the Vinkor adjuster in the pre-amplifier for maximum output signal, reducing the input if necessary to maintain the 2 V p-p output. (The output signal may have a broken-up, noisy appearance; this is normal.) For the coil adjustment it is recommended that the pre-amplifier be removed from the front panel and the screening box earthed by resting it on the metal plate supporting the Airmec receiver. If only *one* maximum is obtained on adjusting the Vinkor throughout its full range, increase the value of C1b AOT. If *no* maximum is obtained reduce the value of C1b. Two spaced maxima should be obtained. Set the Vinkor adjuster to the maximum at which the core is furthest in.
8. Select a value of R10 (across C1b) so that for 100-dB attenuation of the signal into the dummy aerial the receiver output signal is present for very roughly 5% of the time. The value of R10 can lie between 33 kilohms and infinity. (Keep the screening box of the pre-pre-amplifier in contact with the plate.)
9. Increase the oscillator output to give an uninterrupted receiver output. Transfer the oscilloscope probe to the front-panel monitoring point; check that the signal is approximately 50 mV p-p
10. Replace the pre-amplifier on the front panel and refit the escutcheon.

References

1. Precision Subcarrier Frequency Monitor. MN7M/504

RDH 8/72