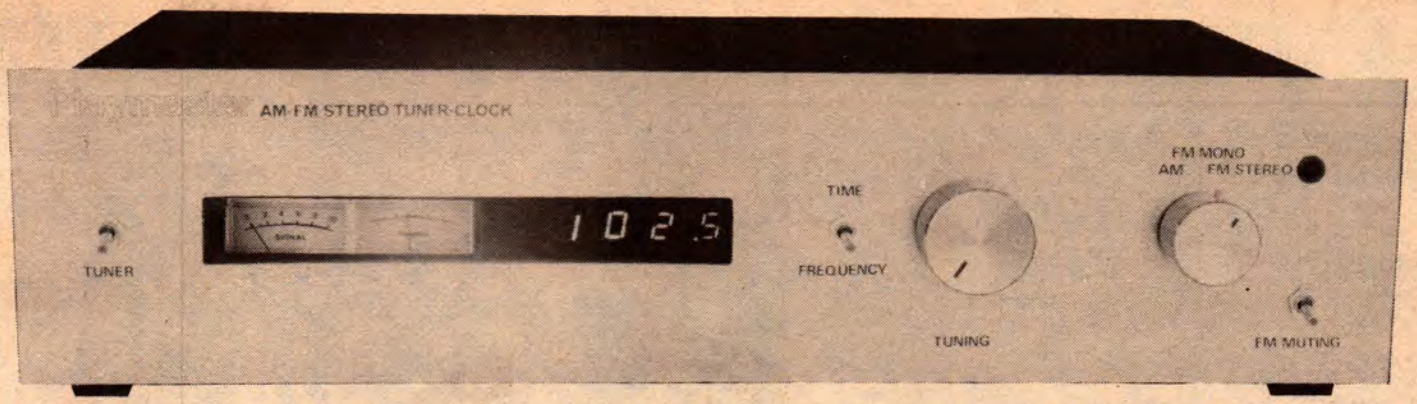


Playmaster AM-FM Stereo Tuner-Clock

third article has a useful trouble-shooting guide

In this third and final article on the new Playmaster AM/FM tuner clock, we give some tips on optimum reception, discuss some of the more likely faults and feature some photographs and PCB artwork held over from the last issue.

by LEO SIMPSON

The previous two articles have provided all the information that should normally be required to construct the tuner and make it fully operational. So now it is appropriate to discuss some features of the unit's operation in order that the best performance is realised by the constructor.

As far as FM reception is concerned, the most important point is the strength of signal fed to the antenna connections. Most people connect their FM tuners to their TV antenna, using a splitter for correct termination. This method should be adequate in most locations, but may prejudice both TV and FM reception in fringe areas, due to the signal losses involved in the splitter. In these cases, separate antennas will be necessary.

A good idea of the signal strength received can be gained by reading the tuner's signal meter and then referring to the meter response graph shown on page 39 of the December 1978 issue. A meter reading of "4", for example, indicates a signal strength of 100 microvolts (across the 300 ohm terminals).

A signal of this order will provide noise-free reception in the mono mode. If the tuner is switched to stereo mode, background noise will be noticeable (as hiss). To eliminate noise from stereo reception, a signal strength of 300uV or more is required. This corresponds to a meter reading of "6" or more.

It is possible that signal strength may be adequate and the reception appropriately noise-free but marred by objectionable distortion. A likely cause of this problem is "multipath" reception, which is akin to "ghosting" in TV reception.

If you suspect that "multipath" reception is a problem, the diagnosis can be confirmed by close observation of the signal strength meter. If the pointer can be seen to be fluctuating in time to the music or voice program, then there is definite indication of multipath. The solution may not be easy but involves the same process used to reduce TV ghosting — selection of a suitable directional antenna and orienting it for best reception. The signal strength meter can be used as an aid in orientation.

Similar remarks can be made about AM reception. While the quality of reception is nothing to become excited about, the AM specifications of this tuner are actually better than those obtained from many commercial tuners. This may be hard to believe, but it's true.

For reasonably noise-free reception the signal strength meter should read "6" or more. If the listener is located in area of relatively weak signals, the tuner and its rod aerial will have to be oriented in order to maximise signal pickup. In areas where very strong signals produce overloading of the AM input stage, the signal pickup can be reduced by pulling the rod closer to the chassis.

It is possible that the aerial rod may need "peaking" to optimise signal pickup. This is done by tuning to a station in the middle of the range and tweaking the aerial rod slug for maximum deflection of the signal strength meter.

Multiplex hash will be audible between stations and will probably interfere with reception of weak stations. This tuner is not really suitable for DX reception of AM, so we do not regard this as a major drawback. Recepton of strong local stations should not be affected.

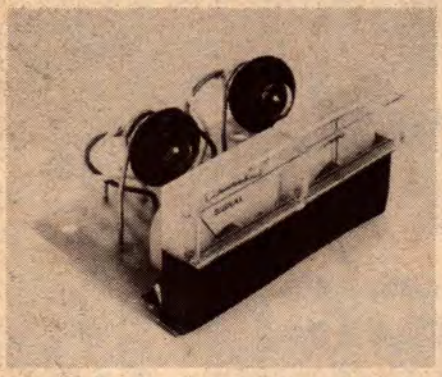
Should you wish to determine whether any interference in the tuner is multiplex hash, you can readily check by depressing both time-setting push-buttons simultaneously. As noted previously, this action blanks the display and will reduce the hash radiation to a low level.

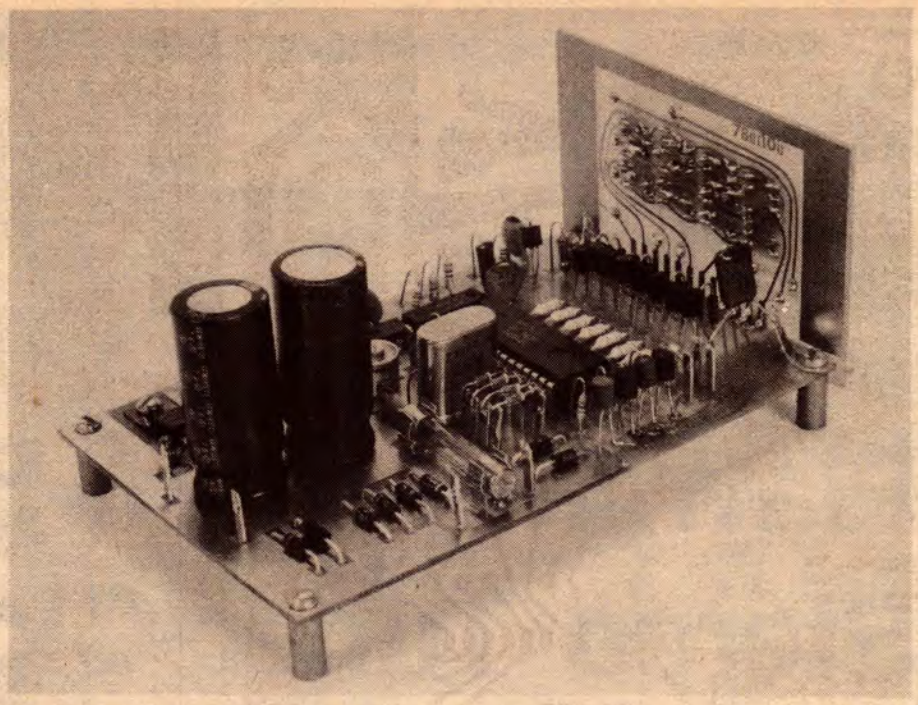
One point we did not mention when writing the earlier articles was the effect of the new AM station spacing of 9kHz which applies as from November 23,

1978. At the time of writing this article (early November) we have not observed the practical effect.

Fortunately, because the Wangine WT-7700 tuner module has a relatively narrow AM bandwidth, the audible effect of 9kHz heterodyne whistles will not be as bad as will be encountered with higher quality AM tuners.

As far as the frequency readout is concerned, the maximum error involved in tuning any one station will be





These photos show the two modules ready for installation in the chassis.

±5kHz. This is because the last digit of the AM frequency display is always zero, a constraint set by the AY-3-8112 IC which was designed to work with AM stations having 10kHz spacing.

Presumably, General Instrument Micro-electronics may eventually produce a frequency readout chip to suit the 9kHz spacing, which now applies to most of the world except for one major holdout, the USA.

The local distributors, General Electronic Services Pty Ltd, have notified General Instrument Corporation of the change.

For the present, the frequency readout error will show up in the following way. For example, Sydney station 2GB, now on 873kHz, will give an indication of 870kHz. And station 2F€, moved to 576kHz from 610kHz, will give an indication of 580kHz.

Constructors may also find that an error occurs with the FM frequency readout. This will be due to an offset error which can be corrected by omitting one or more of the programming diodes D1 to D4.

By using differing combinations of diodes D1 to D4, the FM offset for the 8112 IC can be varied to suit intermediate frequencies from 10.46mHz to 10.76MHz. The table is as follows:

10.76MHz	D1, 2, 3, 4
10.74MHz	D1, 2, 3
10.72MHz	D1, 2
10.70MHz	D2, 3
10.68MHz	D2
10.66MHz	D3, 4
10.64MHz	D3
10.62MHz	D1, 3
10.60MHz	none
10.58MHz	D1, 4
10.56MHz	D1
10.54MHz	D1, 2
10.52MHz	D4
10.50MHz	D3, 4
10.48MHz	D2, 3, 4
10.46MHz	D1, 3, 4

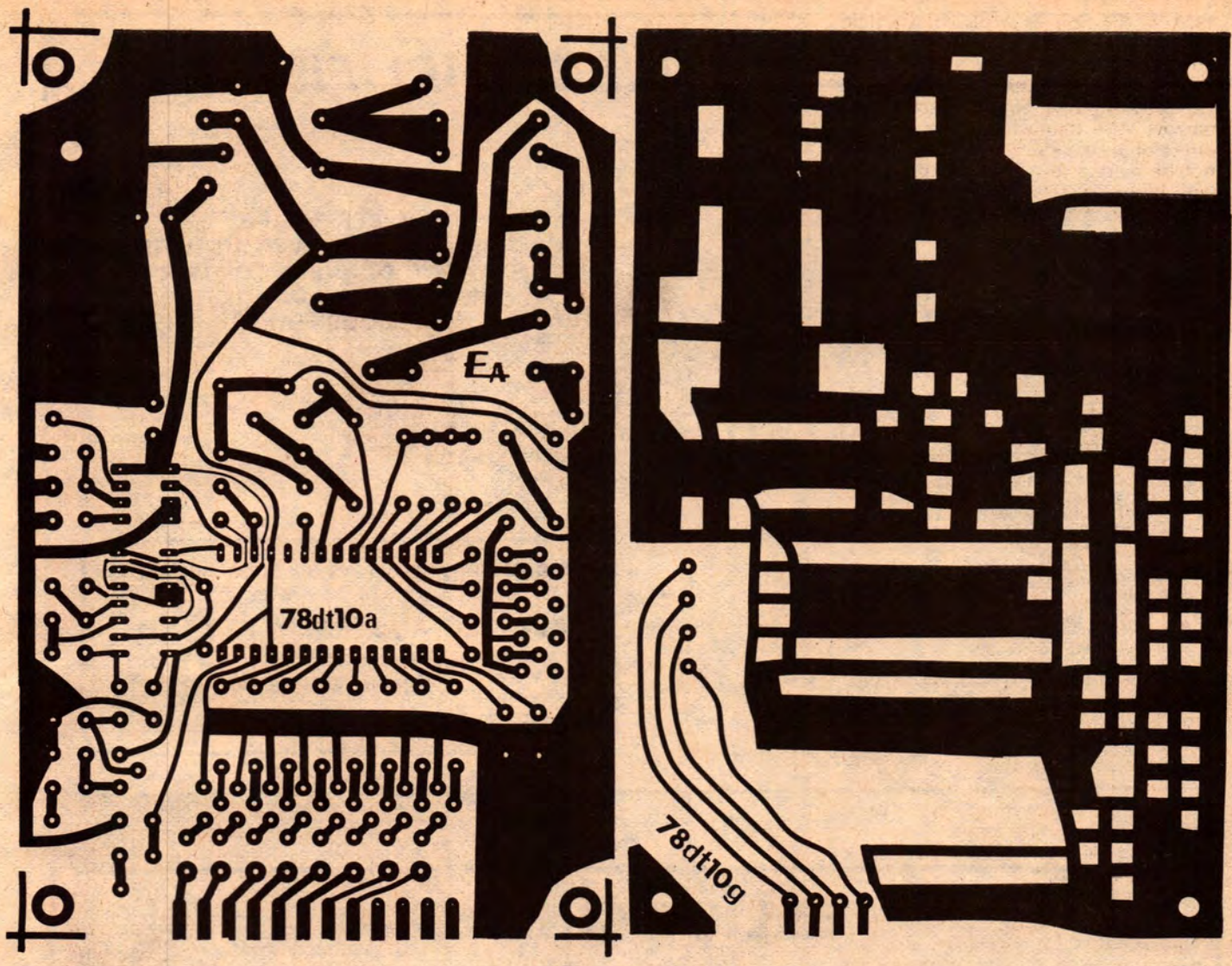
By way of explanation, while most FM tuners have a nominal intermediate frequency of 10.7MHz, the actual IF may be up to several 100kHz above or below this figure. This applies whether or not the IF strip uses ceramic filters. The Murata SFE10.7MA filters used in the Wangine WT-7700 module are manufactured to five specified centre-frequencies, and are coded with a coloured dot:

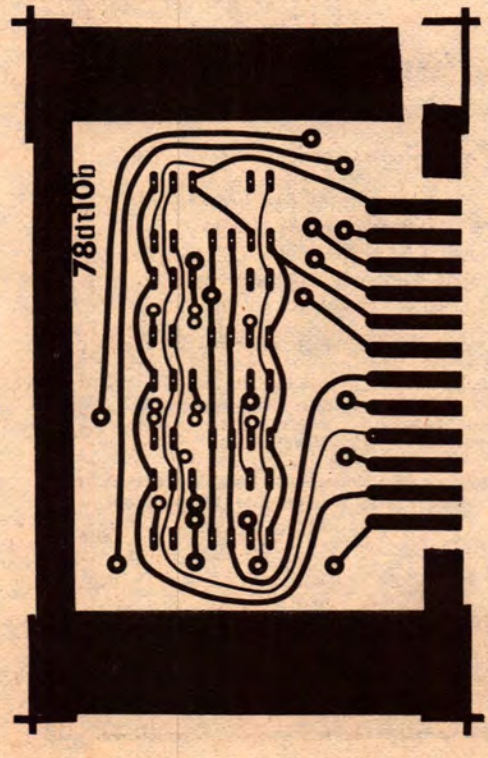
10.80MHz ± 35kHz	Yellow
10.75MHz ± 35kHz	White
10.70MHz ± 35kHz	Red
10.65MHz ± 35kHz	Black
10.60MHz ± 35kHz	Green

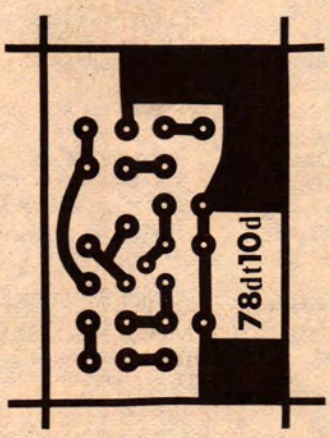
Accordingly, by looking at the colour code dots on the SFE10.7MA filters on your module (they're close to the oscillator shield), you can decide on which combination of diodes to use. Therefore, if the filters are coded with yellow or white dots, D1, 2, 3 and 4 can be left in place. If the code is red, omit D1 and D4. If green, omit D1 to D4.

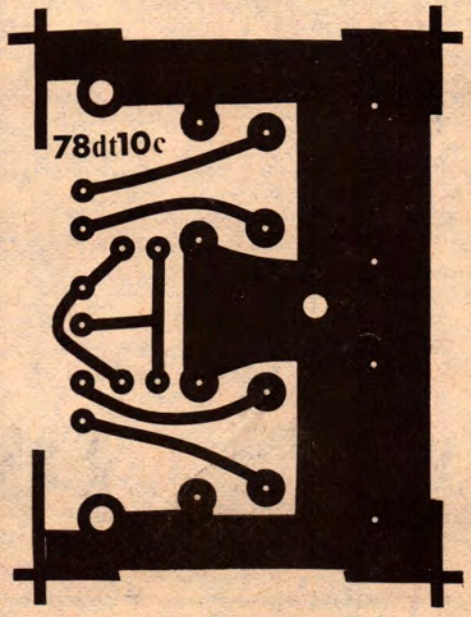
The above selection is fairly rough and ready but is adequate since the 8112 gives a readout of the centre of the channel even if the tuner mistuned by ±100kHz. In any case, the frequency readout is used only as a guide to the tuned frequency. For accurate tuning, the tuning meter must be used.

A more precise method of selecting the programming diodes is to use a digital frequency meter, in the following way. Accurately tune to an FM station of known frequency (using the

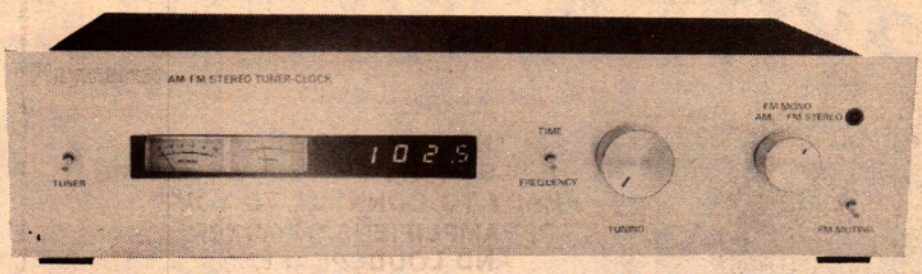








These are the patterns for the four PCBs, including the ground plane.



tuning meter). Measure the prescaled frequency at the output of the DS8629 IC (pin 2) and multiply by 100. Now subtract the station frequency to obtain the actual intermediate frequency for the tuner, and select the programming diodes accordingly.

Setting the crystal oscillator trimmer capacitor for accurate time-keeping is a matter of trial and error. Since the clock function has no "seconds" readout, the accuracy of the timekeeping can only be measured by comparing the changeover of the "minutes" digit with the time signals on the radio or telephone.

At the time of writing only a few of the Playmaster tuners have been built and these have been relatively fault-free. However, our experience with these prototypes is a guide to some of the common faults which constructors may come across.

Most of the likely faults will be visually indicated by the digital readout and most of these are likely to be missing segments or missing digits.

First point to remember is that all segment lines are common. The table below shows the pin connections to LT-302 and DL-707 LED displays. The segment and digit connections to the AY-5-8112 are shown on the main circuit diagram published last month. This data enables the segment and digit lines to be checked for continuity, using a multimeter.

pin 1	segment A
pin 2	segment F
pin 3	anode E,F,G,DP
pin 6	decimal point
pin 7	segment E
pin 8	segment D
pin 9	anode C,D
pin 10	segment C
pin 11	segment G
pin 13	segment B
pin 14	anode A,B

Actually, the pin connections for the LT-302 and DL-707 are not exactly the same. With the LT-302, anode pins 3 and 14 are internally connected while pin 9 is used for the right-hand decimal point cathode. This means that a good few of the 15 links on the display PCB are superfluous if the LT-302s are used.

If the displays are very dim, then it is probable that you have inserted the transistors incorrectly. If you are supplied with 2N3904 and 2N3905 transistors their orientation should be reversed to that shown in the photographs. On the 2N3904/5 the leads are in a straight line and reversed in order to that for the BC328/338 series.

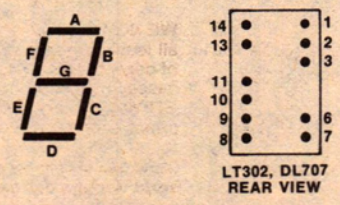
If one segment of one display is missing, the fault lies with that particular display — most probably it is a bad connection. On the other hand, if the "A" segment, for example, is missing from each digit, then the fault could lie with the display, transistor Q5 or the 8112. The latter case is the least likely of the three.

Q5 (and all the other bipolar transistors) can be checked with power applied. Just short Q5 between base and collector (carefully now). If the "A" segments all light up, then Q5 is okay. If not, then Q5 is faulty or there is an open-circuit between Q5 and the "A" segment line. If Q5 proves to okay, check if the "A" segments all light when the base of Q5 is shorted to the base of another segment driver transistor. If they do, there is an open-circuit in the base line to Q5 or the 8112 IC is now a useless piece of plastic.

Note: The display should be set to read "880" on AM or "88.9" on FM in order to be able to check segment operation on the last three digits. On the first digit, only two segments are displayed (ie, for "1").

A similar procedure can be used to cure missing digits.

Under dim lighting conditions, you may notice that when the leading digit should be blanked (for three-digit displays, for example), some segments are glowing slightly. This can be improved by adding another diode in series with D5 and D6. Lift one end of D5 or D6 up and solder one end of the extra diode to the position vacated. Then twist the ends of the two diodes together and solder.



LT302, DL707
REAR VIEW

Does the frequency display work? If not, it could be because the tuner module is not working or because Q13, Q14 or the interface ICs are malfunctioning.

If you are unlucky enough to short out the tuner supply (P12) accidentally, the most likely casualty apart from the fuse, is the regulator transistor on the tuner module, near P12. This can be replaced with a TIP31, which has the same lead configuration.

If the FM display becomes unreliable or intermittent as the tuned frequency goes higher, it is likely that Q14 is a little low in gain. The situation can be cured by reducing the 220 ohm resistor from Q14. The resistor should be reduced to the point where the display is reliable over the whole frequency range. Do not reduce it more than necessary, otherwise multiplex hash will become a significant component of the residual noise.

If the FM display shows "189.3" either Q14 or the 8629 IC is not working at all. Similarly, if the AM display shows "1550", either the 7400 IC or Q13 is not working. In both cases, check that the inputs from the respective local oscillators are actually connected. Apart from this, the easiest way to check these parts of the circuit is by substitution.

One other fault which occurred with one of our prototype modules was failure to operate in the stereo mode. This proved to be due to maladjustment of the multiplex decoder (HA1156) internal oscillator, probably as a result of an inadvertent nudge to the 10k preset potentiometer (associated with pin 14). This can be adjusted precisely with the aid of a frequency meter so that the output at pin 10 is exactly 19kHz.

Another method which will give reasonable results is as follows: Set the tuner to receive a station known to be transmitting in stereo. Now tweak the 10k pot (with 15k resistor adjacent) so that the stereo beacon lights. Continue turning the pot until the LED extinguishes. Now set the pot wiper in the middle of the range for optimum results.