

Application Note

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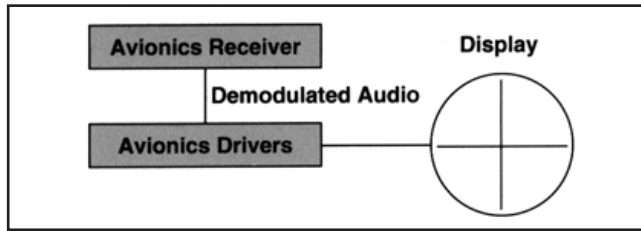
Control of the Low Frequency Generators in the Avionics Mode



The amplitude of the LF output on 2030/40 series Avionics Signal Generators can be controlled by adjustment of the amplitude modulation depths of the ILS and VOR waveforms

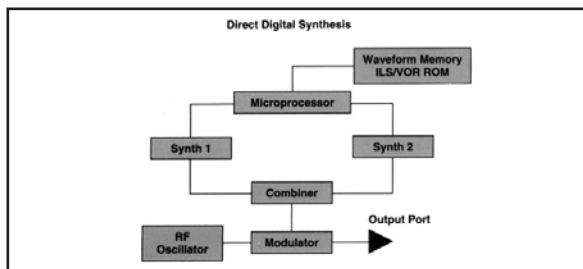
Introduction

Avionics receivers for VOR and ILS provide demodulated audio outputs that are used to drive aircraft cockpit display unit controllers and auto-pilot systems. To enable the testing of this circuitry in isolation from the avionics receiver, the test signal generator must be able to simulate the required audio signals with variable amplitudes.



2030 Signal Generator Architecture

In the avionics mode the 2030 employs direct digital synthesis techniques to generate the audio modulation waveforms. The use of this technology enables the generation of extremely accurate and repeatable waveforms. However, in the interests of flight safety, direct amplitude control of the audio synthesizers is inhibited to ensure that only calibrated avionics waveforms are applied to the RF modulator. In this manner, the test engineer is prevented from applying a non standard avionics signal to the receiver under test which ensures accurate and reliable calibration.



2030 Low Frequency Synthesizer Control

The amplitude modulation circuits in the 2030 are calibrated for 100 % modulation with a 1 V RMS input signal. It therefore follows that a 1 mV RMS input results in 0.1 % AM modulation and that any other value can be simply calculated from this known state. For instance 25 % modulation requires a 250 mV input to the modulator.

The internal low frequency synthesizer's output is always present at the LF output port even when the synthesizers are allocated to modulation drive. Therefore the output voltage present at the LF port is proportional to the AM modulation depths selected on the signal generator.

To set any given output voltage at the LF port the percentage of amplitude modulation must be adjusted to the proportional value. For example, to set 100 mV at the LF port the AM depth should be set to 10 %.

VOR Mode

In the VOR mode the signal generator is set to composite AM mode which enables the generation of two modulation signals. One of these is the 9960 Hz sub-carrier and the other is the 30 Hz reference phase signal. The default setting is for each tone to generate 30 % AM.

The two AM modulation channel depths can be adjusted to provide the desired voltage at the LF output as shown in Table 1.

Output Voltage		9960 Hz Mod Depth	30 Hz Mod Depth
Sub	Ref		
300 mV	300 mV	30%	30%
250 mV	250 mV	25%	25%
100 mV	400 mV	10%	40%
500 mV	50 mV	50%	5%

Table 1

ILS Mode

To use the LF output to test ILS displays, the procedure is similar to the VOR mode. However, due to the method of ILS waveform generation it must be set up in a different manner.

The controls available in the ILS mode set the DDM and SDM. Varying the control settings will produce equivalent changes on the LF output as shown in Table 2.

150 Hz LF Level	90 Hz LF Level	Arithmetic Level	SDM %	DDM %	Fly command
200 mV	200 mV	400 mV	40%	0%	on course
300 mV	100 mV	400 mV	40%	10%	left
100 mV	300 mV	400 mV	40%	10%	right
400 mV	400 mV	800 mV	80%	0%	on course
225 mV	575 mV	800 mV	80%	17.5%	down
190 mV	190 mV	380 mV	38%	0%	on course

Table 2

For clarity the arithmetic sum of the levels is shown in Table 2. Because of the phase relationships between the 90 and 150 Hz tones, a voltmeter will not indicate this level.

Note: It is not possible to achieve greater than a total 100 % amplitude modulation in any mode. Attempting to exceed this figure will result in an error message warning the operator that AM has been limited to a total of 100 %.

An alternative method of testing the ILS displays is to set the avionics signal generator to composite AM mode, instead of the avionics mode. With the AM channels set to provide 90 Hz and 150 Hz signals and the Mod Source Phase set to 0°, the AM depth of each tone can be individually set and the LF output will behave in a similar way to that described for the VOR mode.

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