

## Distribution Amplifier

Today, the ability to obtain multiple outputs from a single input of a generator is vital. This type of situation may be encountered in engineering laboratories, national standards laboratories, research and development, calibration laboratories and production. Another purpose for such a device is to provide distribution of signals from other precision frequency standards like hydrogen masers, caesium oscillators; GPS disciplined oscillators, rubidium oscillator, and quartz crystal oscillators. It is paramount that the distribution amplifier maintains the high quality of such input signals. As such, any decent distribution amplifier will have the following three features: High isolation between the inputs and the outputs, low harmonic distortion and low phase noise. Additionally, it is advantageous if the amplifier retains the original input signal characteristics. It is possible for the output signal to possess different characteristics than the input signal. Two possibilities (assuming the input signal is broad band) are to have tuned outputs and ground isolated outputs; whilst tuned outputs are useful for the distribution of standard frequencies where delay variation between outputs is not important ground isolated outputs may be used if long lengths of cable are used to drive instruments where ground potential differences exist. Depending upon the particular application required, the number of outputs available is important. Obviously the number of outputs increases the cost, but by how much?

It is also essential for many such applications that the unit provide a continuous distribution of frequencies, even if the dc power supply should fail. The distribution amplifier must therefore have (auto) battery backup switching to allow for this. Current is only taken from the battery if the line power supplies drops below a pre-set threshold, even if the float battery voltage is higher than the line supply voltage. In order that the user be aware of battery connection and that the battery is above the switching threshold a 'battery available' LED is likely to be provided. In addition a 'battery in use' LED is provided to indicate to the user that the battery is supplying current to the equipment.

The distribution amplifier may be thought of as being composed of a number of extremely low phase-noise isolation amplifiers driven from between 1-4 equally high performance input amplifiers. The isolation amplifier would have, normally, 4 outputs. The input amplifier board has, typically, between 2 and 8 outputs and is designed to drive a number of isolation amplifier boards. Considering the isolation amplifier board, 4 of these amplifier boards are used to drive the four 50W outputs on each board. These are called the output amplifiers and comprise separate small boards mounted on the isolation amplifier board.

However, the range of devices on the market is small and the number able to deliver this signal without significant degradation of the signal even smaller. Three companies offering such devices are the big American companies, Datum (FTS 6502) and Hewlett Packard (HP 58502) and a small British company, Quartzlock (A5). The Quartzlock model is an especially interesting model, offering between 4 and 32 outputs (in multiples of 4) and between 1 and 4 inputs. This allows a potential buyer to weigh up their needs against the cost involved in providing additional outputs, thus ensuring maximum value for money. Of the 3, the Quartzlock model exhibits the best phase noise (SSB), with a value of -165 dBc/Hz in a 1 Hz bandwidth at an offset frequency of 10 kHz. The HP

and Datum models offer a wider frequency response (0.1MHz to 10MHz) than the Quartzlock model, but fail to match the A5 in the maximum frequency at input of 100MHz. This is to assure the A5 is compatible with the CH1-75 or CH1-76 hydrogen masers. All three models offer excellent spurious outputs (<110 dBc), harmonics and channel-to-channel isolation (the A5 offers 130dB between non-adjacent 5MHz outputs). The Quartzlock model also displays excellent output to input isolation of 110dB at 10MHz and input-to-input isolation (also known as crosstalk) of 90dB at 5MHz. The output level common to all three devices is 1V(RMS) into 50W

The Quartzlock model is an adaptable and configurable distribution amplifier that offers the user the possibility of obtaining up to 32 outputs from between 1 to 4 RF sine wave reference signals. When combined with the CH1-75 active hydrogen maser, the A5 enables probably the most accurate method in the world of procuring multiple stable outputs for use in the laboratory.