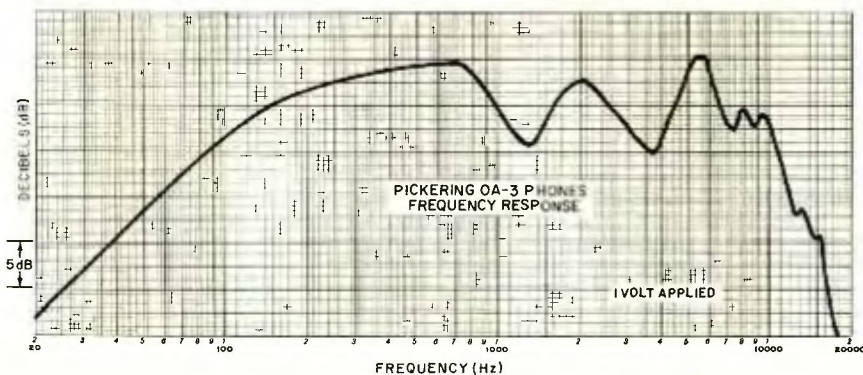




The published specifications of the Model OA-3 phones indicate that they are quite efficient, requiring only 0.1 volt across their nominal 15-ohm impedance to produce a 100-dB sound pressure level (SPL) at 1000 Hz. The maximum rated input power is 0.2 watt/channel, but the series resistors built into all amplifier headphone output circuits will provide adequate protection even with a high-powered amplifier. The distortion is specified at 0.5 percent for a 110-dB SPL output.

The Pickering Model OA-3 headphones are supplied with an adapter plug to permit them to be used with small transistor radios and cassette decks. Retail price of the phones is \$39.95.

Laboratory Measurements. We tested the frequency response of the phones on a Koss-designed coupler, which is a slightly modified version of an accepted standard earphone coupler. The measured frequency response of any headphone is closely connected with the dimensions of the coupler (or artificial ear) on which it is

mounted so that it is virtually impossible to compare data on different coupler designs, especially at the higher frequencies. However, one can obtain a reasonably valid picture of the headphone's overall response even though the specific peaks and dips on the response curve may be as much a property of the coupler as of the phone (and would certainly be still different through the ears of any individual wearing the phones).

The measured frequency response was relatively uniform from 100 Hz to 11,000 Hz, with a total variation of only ± 5 dB over that range. The output fell rather quickly at frequencies beyond 11,000 Hz and at a smooth 6 dB/octave at low frequencies. The response was measured with 1 volt applied to the phones, producing an average 120-dB SPL over the measurement range, which happens to agree exactly with the published specifications.

Normally, one would expect distortion to be a function of frequency, but the published specifications do not specify the test frequency. We measured the distortion at several fre-

quencies between 200 Hz and 1000 Hz, where the output was both strong and smooth, at a 110-dB SPL. The distortion was typically between 1.2 and 1.6 percent and was principally second harmonic. In view of the high SPL used, this amount of distortion cannot be considered serious even if it does slightly exceed the published rating.

The electrical impedance of the phones was an almost constant 20 ohms across the audio range. It gently rose to 25 ohms at 150 Hz and underwent a slight drop to a 16-ohm minimum at 20 Hz.

Comment. Since our first experience with open-air phones several years ago, we have enjoyed their special qualities—which eliminate many of the objections voiced about headphone listening (heavy weight and pressure exerted, inability to hear desired outside sounds, such as the ring of a telephone, etc.). The Model OA-3 phones embody all the virtues of a good open-air headphone and have a smooth response and the ability to handle high volume levels without objectionable distortion.

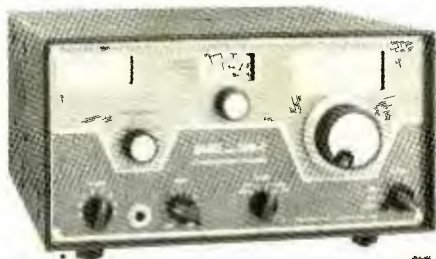
The vinyl-coated ear cushions make the Pickering phones a little less “open” to outside noises than are some other types that feature simple foam pads. In fact, in a quiet room, one might almost believe that the phones are the isolating type.

The low impedance and high efficiency of the phones makes them exceptionally well suited for use with small radio receivers and tape recorders.

CIRCLE NO. 67 ON READER SERVICE CARD

DRAKE MODEL SPR-4 COMMUNICATIONS RECEIVER **(A Hirsch-Houck Labs Report)**

Versatile solid-state receiver for shortwave, amateur radio, CB



THE Drake Model SPR-4 solid-state communications receiver covers any 23 bands (each 100-kHz wide) between 150 kHz and 30 MHz. Thus, it offers the user reception of international SW, amateur radio, and CB radio transmissions, among others.

The receiver measures 12¼ in. deep by 10¾ in. wide by 5½ in. high (31.1 × 27.3 × 14 cm) and weighs 18 lb (8.2 kg). Its built-in 5-in. by 3-in. (12.7 × 7.6-cm) speaker is mounted on the left side of the metal receiver cabinet. The price of the Model SPR-4 receiver is \$579. Various crystal kits are available for the amateur radio, marine, aeronautical, MARS, Citizens Radio, and other special-interest bands. The external optional speaker, 100-kHz calibrator, and noise blanker are priced at, respectively, \$22, \$20, and \$65.

Technical Details. The receiver employs a double-conversion superheterodyne design. Its first i-f of 5645

kHz is obtained by the mixed product of a crystal oscillator selected by the band switch, while a stable permeability-tuned oscillator (PTO) takes care of the 4955-kHz to 5466-kHz range. The PTO alone is used for the lowest-frequency band.

Following the first mixer, selectivity is provided by a crystal filter, and the signal goes without further amplification to the second mixer. Here, it is converted by a crystal oscillator (with switched crystals for USB and LSB reception) to 50 kHz. Then a four-pole LC filter and a tunable-notch filter provide additional selectivity. After two stages of i-f amplification, the signal goes to a product detector for

SSB and CW or a separate diode detector for AM. The audio amplifier is rated at 3 watts output into a 4-ohm speaker load.

The PTO's dial is calibrated at 1-kHz intervals from 0 to 500, with about 50 kHz of "overrun" at each end. The dial's reference mark can be shifted to calibrate the receiver precisely to any known frequency. At the upper center of the receiver's front panel is a small opening for the frequency range dial, which is marked to indicate each of the 10 basic bands, together with the appropriate settings of the RANGE switch and the PRESELECTOR control knob. Decals are supplied for the 13 blank spaces on the dial, to be added when other crystals are installed.

The front-panel controls include concentric a-f and r-f gain controls, mode switch (with positions for AM, CW, LSB, and USB), and an accessory switch. The last activates an optional 100-kHz crystal calibrator and i-f noise blanker when they are installed. Concentric with the accessory switch is a knob that is used to tune the rejection notch filter through the i-f passband to reduce interference from heterodynes.

On the rear apron of the receiver are phono jacks for the antenna and muting connections and an audio in/out jack that can be used either to supply a signal to a tape recorder, ahead of the volume control, or to amplify an external signal through the SPR-4's amplifier. There is also a 120/240-volt line selector and a switch that disables the dial lights for low battery drain (only 2.5 watts at 12 volts).

Laboratory Measurements. The Model SPR-4 receiver has sensitivity ratings for a 10-dB (S + N)/N ratio of 0.25 μ V on CW and SSB and 0.5 μ V for AM at 30 percent modulation. We measured the sensitivity at the center of each band (except the two lowest where the input impedance is too high to match our signal generator). It proved to be substantially better than claimed and varied little from band to band.

The CW sensitivity measured better than 0.15 μ V throughout and about 0.1 μ V on most bands. The SSB sensitivity was typically about 0.18 μ V and reached 0.22 μ V on the highest and lowest frequency bands tested. The AM sensitivity was better than 0.35 μ V

and was typically a little better than 0.30 μ V.

The agc is stated to hold the audio level within 6 dB for an input signal variation of 100 dB. We were able to check it over only an 86-dB signal range, where it varied by only 3.2 dB. The i-f bandwidths at the -6-dB points were essentially as rated: 4.8 kHz on AM, 2.4 kHz on SSB, and 0.4 kHz on CW.

The dial calibration was within 1 kHz on all bands, even without "zeroing" the dial on each range as recommended. When we set the zero at either end of the tuning range, the dial was about as accurate as it could be read—certainly within 200 Hz at all points. And there was no discernible drift over extended periods; the rating, incidentally, is less than ± 100 Hz.

The S meter is, of course, a relative signal strength indicator. On the 7-MHz band, an input of 1.8 μ V gave an S2 indication, while S9 was attained with only 17 μ V of input signal strength. This is by any standards a most "generous" meter. Furthermore, a reading of S9 + 20 dB required 38 μ V, which is only about 6 dB greater than the S9 input. To reach S9 + 40

TIGER "B" — BASIC POWER

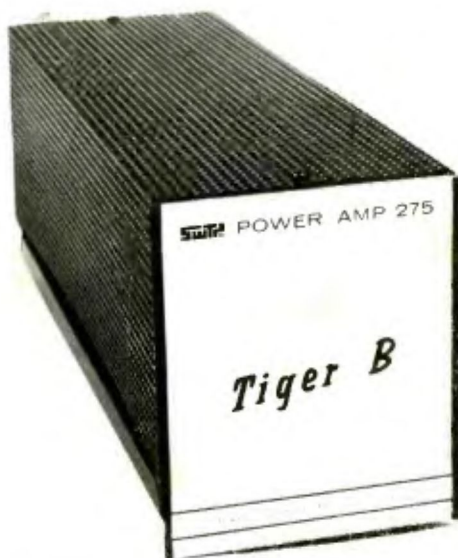
Now available, our latest version of the amplifier that started it all; the faithful old "Universal Tiger". We have put him in a fancy new chassis and added our famous complementary differential input circuit, but this is still the rugged, low distortion, economical amplifier that thousands of you out there love so well. With a power output of 75 Watt into an 8.0 Ohm load, or 90 Watt into 4.0 Ohms the "Tiger B" is the ideal BASIC amplifier for all types of applications; from HiFi systems to public address work, to instrument amplifiers; you name it. With its tremendous frequency response, -1.0 dB at 1.0 Hz and 100KHz and super low distortion of .05% IM at rated output, Tiger "B" is ideal for almost any application using an audio amplifier.

Nothing but the best components and first quality fibre-glass circuit boards are used in this kit. The chassis is bronze anodized and the perforated metal cover is standard.

For those who insist on "gilding the lilly" we have an accessory kit to add an output meter, input level control, overheat indicator lamp, front panel power switch, etc.

Circle our reader service number for your free copy of our latest catalog.

275 Amplifier Kit (single channel).....\$64.50 PPD
AC-275 Accessory Kit.....\$ 7.90 PPD



Southwest Technical Products Corp.
219 W. Rhapsody,
San Antonio, Texas 78216

dB, we had to supply a 5500 μ V input, which is actually 50 dB over the S9 input and 43 dB over the S9 + 20 input.

Comment. The Drake Model SPR-4 receiver, in spite of its deceptively simple appearance, is a highly sophisticated unit. It is not to be confused with the many low-priced "communication receivers" directed toward the young SWL and novice ham. It may be

simple enough to be operated by beginners, but it is obviously meant for the advanced SWL, while also offering excellent flexibility for the intermediate and advanced operator.

The SWL in search of an elusive DX station can set the dial to the station's frequency with complete assurance that he is tuned to what the dial says. In addition, if his antenna and propagation conditions are right, he will surely

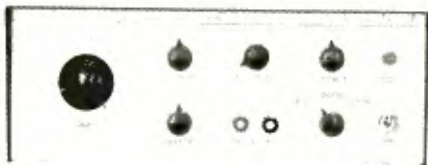
hear the station he is after—assuming, of course, it is on the air.

If you plan to buy the Model SPR-4 receiver, we feel you should seriously consider including the optional crystal calibrator in your order. Without it, the receiver will probably be tuned to within a kilohertz of the indicated frequency, but why settle for that when it can be "on the nose?"

CIRCLE NO. 68 ON READER SERVICE CARD

AMERICAN CIRCUITS & SYSTEMS MODEL MK1 FUNCTION GENERATOR

Sine, square, or triangle waveforms from 6 Hz to beyond 1.25 MHz



THANKS to low-cost integrated circuits and new approaches in design, a very important change is taking place in audio (and digital) signal generators. Until fairly recently, audio signal generators simply provided sine and square waves that were variable in level and covered a frequency range of about 20 Hz to 100,000 Hz. The new "function" generators that have begun to make their appearance, by contrast, provide sine, square, and triangle (or ramp) waves over a range of about 10 Hz to 1 MHz and beyond.

One good example of a low-cost function generator is the Model MK1 made by American Circuits & Systems, Inc. The MK1 sells for \$135 in kit form. It is also available factory-wired, tested, and adjusted for \$195.

The Model MK1 function generator features sine-, square-, and triangle-wave outputs that are selectable by a WAVEFORM switch. The waveforms, available at a pair of color-coded binding posts on the front panel, are continuously variable from 0 to 20 volts peak-to-peak via an AMPLITUDE control. Another control, labelled ATTENUATE, can be used to provide 0, 20, or 40 dB of attenuation.

Built into the instrument is a dc OFFSET control that permits the ac signal to be dc biased anywhere from +10 to -10 volt into an open circuit (± 5 volts into 600 ohms).

Selecting a frequency is a two-step process: First, the RANGE switch must be set to the desired position (X10, X100, X1K, X10K, X100K). Then, the FREQUENCY control, calibrated in equally spaced increments from 0.9 to

11, is set for the desired frequency. Hence, if you wanted a 5000-Hz output frequency, you would set the RANGE switch to X1K and the FREQUENCY control to 5. (The actual range of the MK1 is from less than 10 Hz to beyond 1.1 MHz.)

On the rear panel of the instrument is a TTL output jack that provides a TTL-compatible signal of the same frequency as that at the OUTPUT binding posts on the front panel. The logic-0 and logic-1 levels of this signal are 0 and +5 volts, respectively. (CMOS logic can be driven directly from the OUTPUT binding posts.)

Also on the rear panel is a VCO input jack that virtually doubles the versatility of the function generator. With the appropriate inputs applied to this jack, the output can be swept through a range of frequencies, be frequency modulated with tone or voice, or be frequency shift keyed.

Within the instrument itself are six IC's, two of which are precision voltage regulators, with the remainder being linear devices. The power supply employs circuit-protecting fusing and operator-protected three-conductor line cord.

Kit Details. We selected the Model MK1 function generator kit for our test report. Upon opening the carton in which it arrived, we were gratified to note that all components were of premium quality. Most of the resistors, even some in noncritical parts of the circuit, were of 5-percent tolerance, while the trimmer potentiometers that serve as hidden set-up controls were of OEM quality. The large printed circuit board on which the majority of the components are mounted is made from G-10 epoxy fiberglass.

Assembly is simple and straightforward, guided by clear step-by-step instructions and detailed drawings.

The only test instruments needed to put the function generator into service order are a multimeter (for the voltage checks) and an oscilloscope (for distortion adjustments). A frequency counter comes in handy, but is not necessary, for calibration. (Three methods of calibration are detailed in the instructions.) Using the scope, the sine-wave distortion can be set within a few percent of optimum, while it can be fully optimized with the aid of a distortion meter.

After Assembly. Once the function generator was ready to be put into service, we subjected it to a few tests. Using a precision frequency counter, we determined that its frequency range was from 6 Hz to 1.254 MHz in five overlapping bands. The FREQUENCY control's dial calibration was well within the specified ± 5 -percent figure over almost the entire range.

The amplitude of the output signals could be adjusted from 0 to slightly more than 20 volts peak-to-peak, while the dc offset was adjustable to its specified ± 10 -volt limits into an open circuit. Triangle waveform linearity was better than 1 percent between 10 Hz and 100 kHz and about 2.8 percent maximum from 100 kHz to 1 MHz. Without using a distortion meter, the distortion in the sine-wave function averaged an excellent 6 percent. When a distortion meter was used, the figure could be optimized at 2.4 percent. All other specifications were met or exceeded.

Comment. The American Circuit & Systems Model MK1 function generator is an excellent buy, particularly in kit form. It offers a quality and versatility that should appeal to the audio or digital experimenter and service technician.

CIRCLE NO. 69 ON READER SERVICE CARD