



# Recent Equipment



To acquaint you with the technical features of current amateur gear.

## SOMMERKAMP IC-2F FM Transceiver

IF ONE is willing to believe that good things really do come in small packages, then the IC-2F must qualify. Here is a solid-state package that is scarcely larger than the *Handbook* — about the same width, not quite as long, and about three times as thick. Contained in this not-so-mysterious black box is a 6-channel, double-conversion superheterodyne receiver, complete with ceramic i-f filters, squelch, and an audio-output capability of 1 watt. The transmitter, also a 6-channel device, is capable of providing a minimum of 10 watts output into a 50-ohm load. The mobileer can connect the transceiver directly to the 12-volt electrical system (negative ground), attach antenna and microphone, then begin enjoying the adventures of fm and repeater operation. The stay-at-home operator can power the unit from the mating ac-operated 12-volt dc supply — the IC-3P — and get into the thick of things from the comfort of his ham shack.

Perhaps one of the most desirable features of the IC-2F is its compactness, especially in situations where the operator does not wish to fill the car's trunk space with amateur equipment. Those who have used surplus commercial two-way fm transceivers, especially the vacuum-tube variety,



The IC-2F is shown here attached to the IC-3P ac power supply. For mobile operation, only the top section of this package is used.

can appreciate the desirability of miniature equipment. But, in addition to the space-saving feature, a solid-state package of the IC-2F species greatly reduces drain on the car battery, thus offering greater overall efficiency of operation to the mobile enthusiast.

### *The Receiver Section*

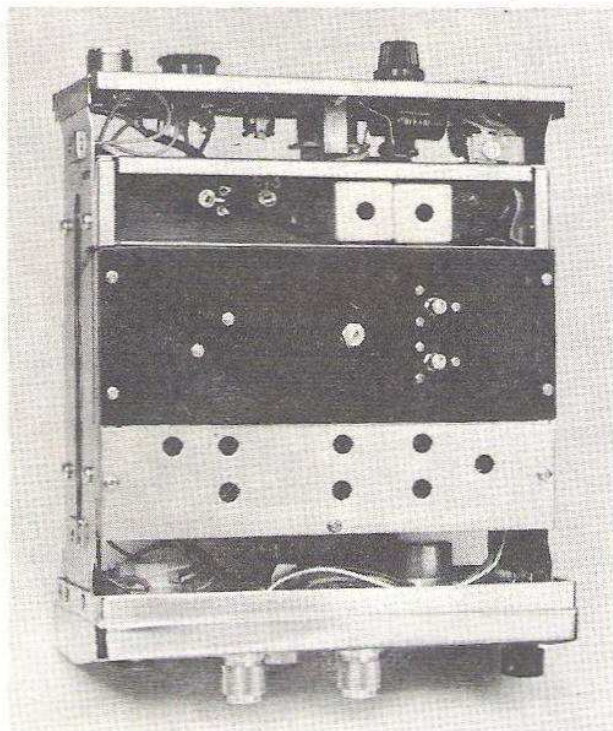
There are 13 bipolar transistors, 1 FET, and 1 integrated circuit in the receiver section of the transceiver. The lineup is shown in the block diagram, Fig. 1. Rf stage Q1 is a JFET whose output is coupled to the first mixer, Q2, through an LC bandpass filter, FL1. The filter provides the front-end selectivity needed to prevent strong out-of-band signals from reaching the first mixer and contributing to cross-modulation effects.

Since the receiver is of the double-conversion variety, i-f filters are used at 10.7 MHz and at 455 kHz. There are two 10.7-MHz filters, and one 455-kHz filter. All three units are ceramic and provide an i-f bandwidth of 15kHz, measured at the 6-dB points on the response curve.

I-f amplification is provided at 455 kHz by two bipolar transistors, Q6 and Q7, and by a portion of integrated circuit U1. The remaining part of U1 serves as the limiter. After limiting, the signal is detected by discriminator diodes CR1 and CR2, and is then routed to the squelch and audio-amplifier channels.

### *Squelch Circuit*

The squelch circuit, shown in Fig. 2, operates smoothly and without evidence of thermal drift. A thermistor, R2, in the bias divider at the base of



The rf power stages of the transmitter are located beneath the large black cover at the center of the photo.

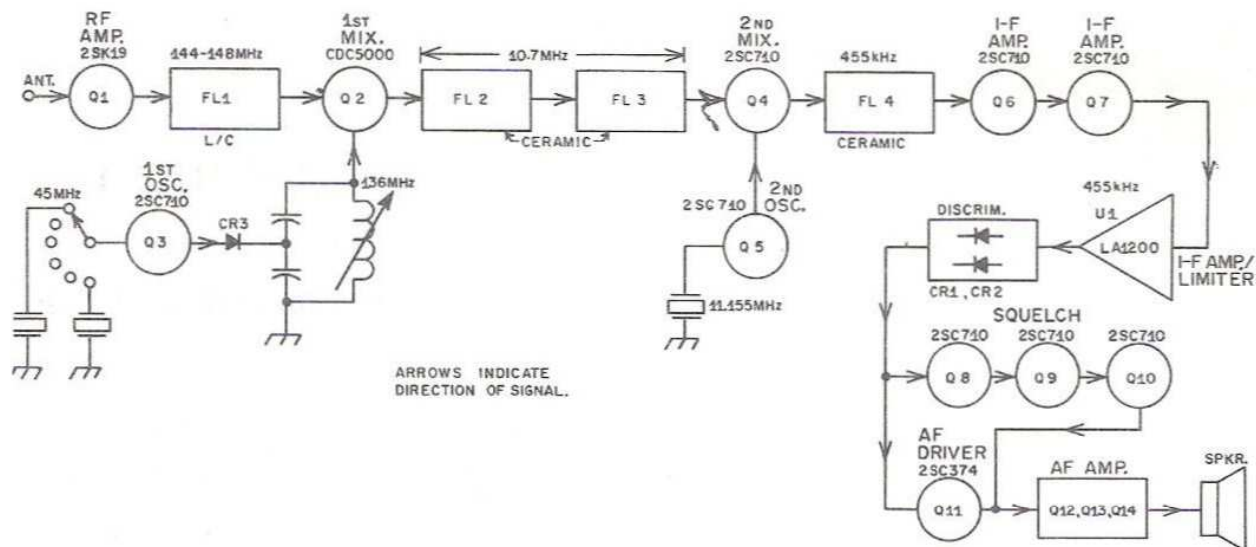


Fig. 1 — Block diagram of the receiver section.

Q8, enhances thermal stability. Tests performed with a Model 80 signal generator indicate that a signal of  $0.3 \mu\text{V}$  or greater will open the squelch. Of course, the squelch control can be turned off (fully counterclockwise) to permit reception of signals weaker than  $0.3 \mu\text{V}$ .

Squelch action is provided by sampling receiver noise at the output of the discriminator. This noise is amplified by Q8 and Q9, then is rectified by voltage-doubler CR4 and CR5 to produce a positive dc voltage which then operates squelch-control transistor Q10, a dc amplifier. Some forward bias is always present at the base of Q10, but the actual amount is governed by the setting of control R1. When no incoming signal is present, the receiver noise, after rectification, drives Q10 into saturation, causing it to act as a switch. When the switch is closed (saturated) the junction of Q10 shorts the audio-input signal and base bias of audio driver Q11 to ground, thus silencing the receiver. When a signal is received ( $0.3 \mu\text{V}$  or stronger) the quieting action caused by the signal reduces the developed squelch voltage to Q10 and opens transistor switch Q10 to permit reception. The greater the value of forward bias placed on Q10 by the setting of R1, the greater the incoming signal level must be to open the squelch.

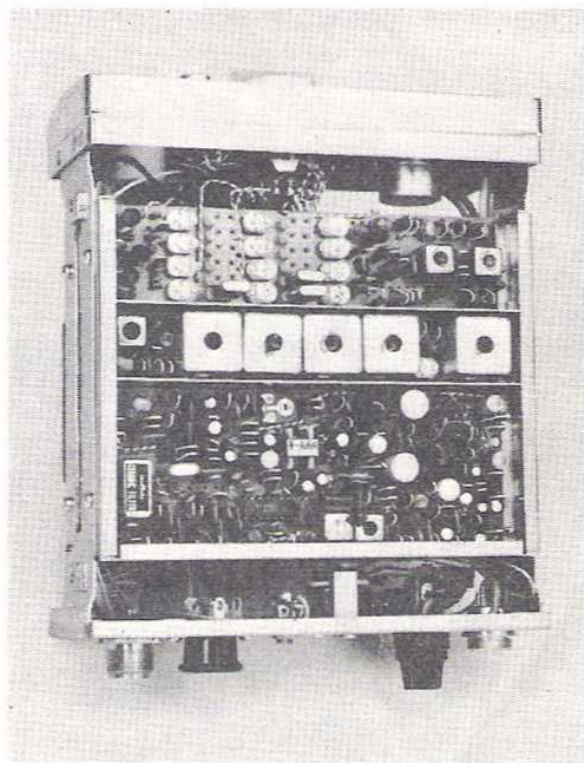
### Receiver Performance

No difficulty was experienced in getting the receiver "on frequency" when using crystals recommended by the manufacturer. Each transmit and receive crystal has its own trimmer capacitor, and adjustment of frequency is a simple matter. Crystals should be ground for a load capacitance of 20 pF and housed in HC-25/U holders. Receive crystals are cut for 45-MHz and are the third-overtone variety.

The receiver has an S meter, which is useful when relative signal-strength comparisons are desired. During operation from the writer's home station no difficulty was experienced with regard to receiver selectivity. K11IG, which operates 146.28/146.88 MHz, and which is line-of-sight from the reviewer's station, drives the IC-2F S

meter to full scale. When the K11IG repeater is in operation it does not interfere with reception of the K1ZJH repeater (146.34/146.94 MHz), which is many miles away, and which delivers an S-6 signal (relative) to the IC-2F.

The manufacturer claims 20 dB of quieting for  $0.4 \mu\text{V}$  or less signal input. Our tests show 20 dB of quieting at  $0.35 \mu\text{V}$ . A homemade dual-gate MOSFET preamp was tried ahead of the receiver. During that test it was possible to obtain 20 dB of quieting at  $0.25 \mu\text{V}$  input. In this writer's view the receiver meets or exceeds all of the manufacturer's performance specifications.



The transmit and receive crystal sockets and trimmers are on the circuit board at the far left. The receiver pc board is at the far right. The transmitter strip is at the center of the chassis.

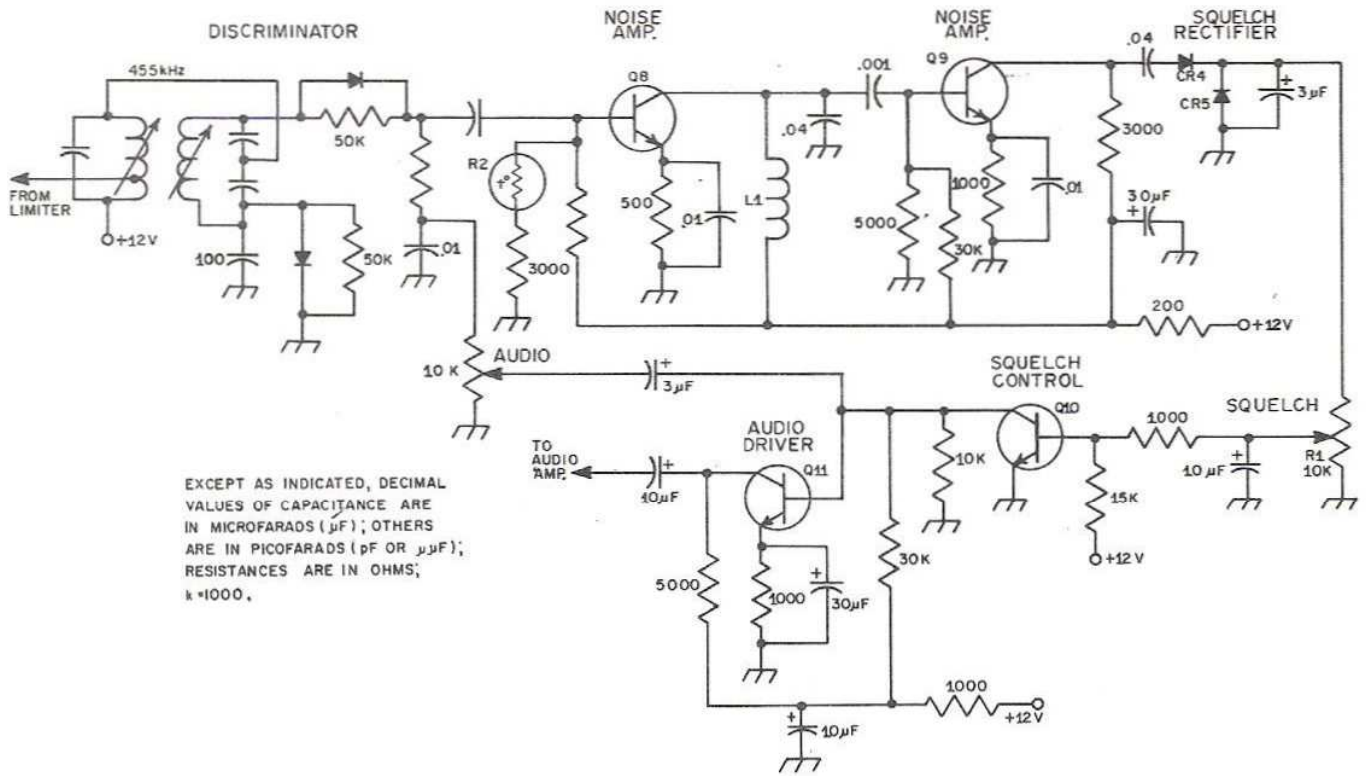


Fig. 2 - Circuit diagram of the squelch circuit used in the IC-2F. Parts values not given are not listed in the operating booklet. Polarized capacitors are electrolytic.

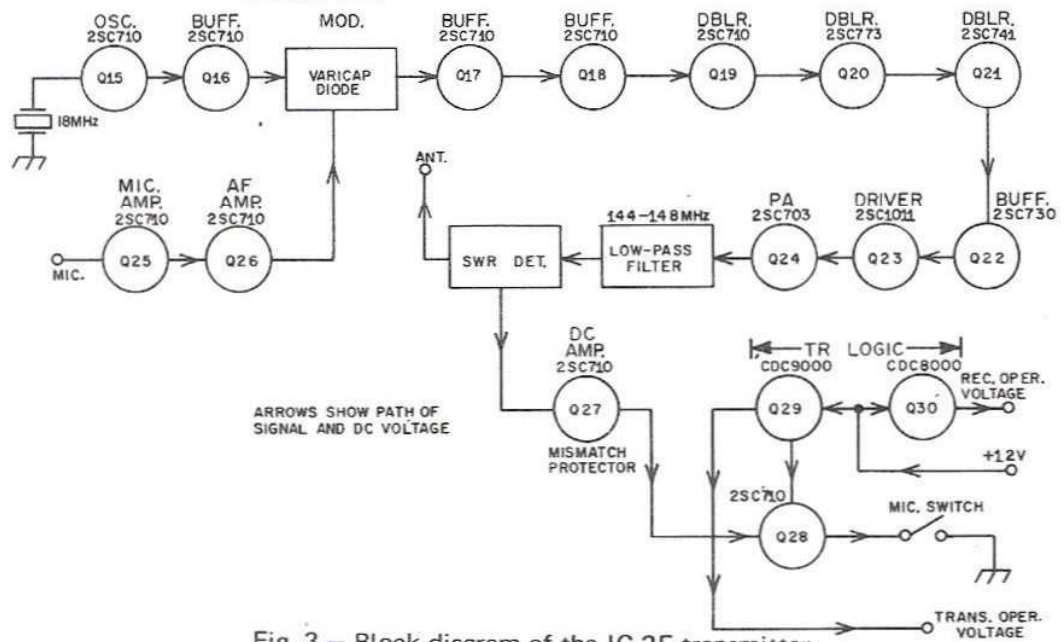


Fig. 3 - Block diagram of the IC-2F transmitter.

**The Transmitter**

There isn't a great deal to say about the solid-state transmitter strip used in the IC-2F except that it performs as specified, transmits a quality signal, and has proved itself to be reliable. It is designed to operate at 20 watts dc input, providing a minimum output power of 10 watts. We found the output to be 13 watts into a 50-ohm load.

The deviation is adjustable up to 15 kHz. Oscillator crystals are of the fundamental type, cut for 18-MHz operation. Each crystal has its own trimmer for adjusting the transmitter to frequency.

Crystal ovens aren't used, but no drift problems have been experienced during two months of daily use under varying temperature conditions.

During transmit, the S meter serves as a relative rf-output indicator. The meter is activated by the forward-power sampling circuit in the Monimatch-type SWR detector shown in the block diagram, Fig. 3. The reflected-power leg of the SWR detector is used to activate a mismatch-protection circuit, Fig. 4, which cuts off the supply voltage to the low-level stages of the transmitter when the antenna becomes shorted, or when an unreasonable amount of reflected power exists. A sensitivity

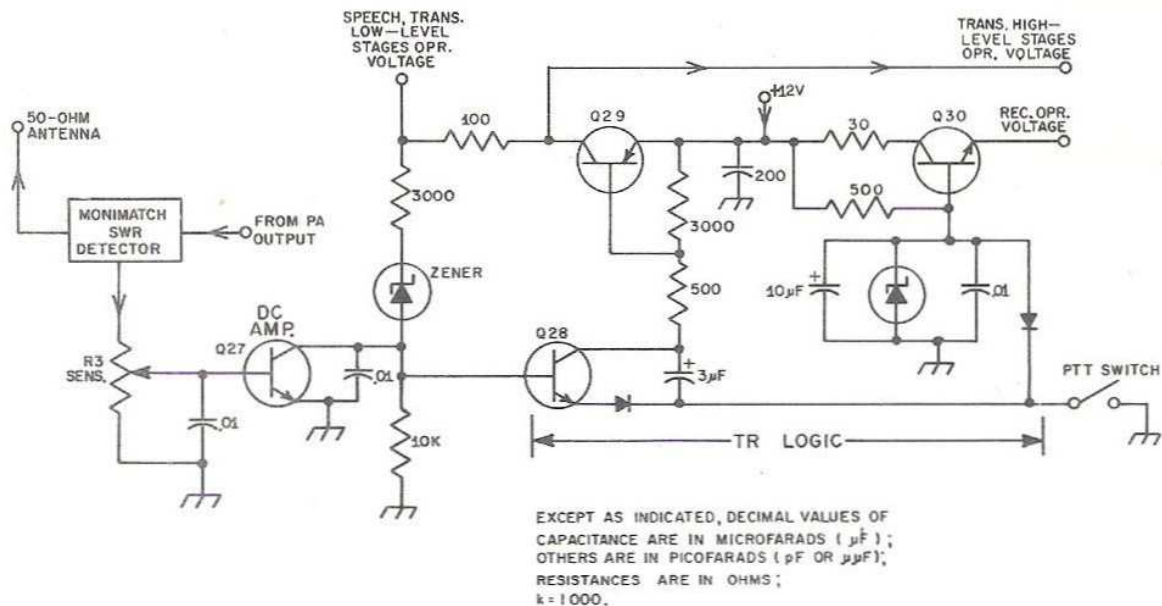


Fig. 4 — Circuit of the TR logic and mismatch-protection circuit. Polarized capacitors are electrolytic.

control is used in the reflected-power leg of the circuit, thereby enabling the operator to adjust the protective circuit for the trip-out point desired. It should be no secret to the reader that PA transistors can be destroyed instantly if the load they look at is highly reactive. With this unique measure of protection it is unlikely that the owner will be privileged (?) to become a member of "Junction Busters, Amalgamated."

### The Protection Circuit

Details of the mismatch sensor and control circuit are given in Fig. 4. Reflected-power energy is rectified and fed to the base of dc amplifier Q27. The reflected-power level at which Q27 saturates is determined by the setting of R3. When saturated, Q27 acts like a switch and shorts out the forward bias on Q28, in turn causing Q28 to be a switch in the "open" condition. When this happens, Q29 can no longer pass dc operating voltage to the transmitter, thus removing drive from the PA stage. The push-to-talk switch on the microphone also operates transistor switch Q28. Removing dc from the transmitter strip when the microphone switch is released. During receive, pass transistor Q30 is saturated to allow operating voltage to reach the receiver portion of the equipment. When the microphone switch is closed, forward bias to Q30 is shorted to ground. This action opens switch Q30 and removes operating voltage from the receiver. Simply stated, the mismatch-protection circuit operates the solid-state TR switch electronically. Normal send-receive operation is effected manually with the PTT switch.

Antenna switching is carried out by means of two diodes which are connected in the output lead of the PA stage, just ahead of the low-pass harmonic filter.

### Some Final Remarks

The workmanship used in the manufacture of this transceiver is superb. The layout is compact and orderly. Servicing should not be difficult

because most of the parts are easy to reach. Parts-placement photos are included in the operating manual — a real aid to the home repairman. A number of test points are provided to help in locating any trouble spot that may exist.

One criticism is worthy of mention. The instruction manual has a few inconsistencies which may confuse the owner. That is, the block diagram does not agree entirely with the schematic diagram. The schematic diagram has a few minor errors too, but this is not an unusual situation when dealing with imported electronic products. Some of the parts values aren't given on the diagram, perhaps because these resistors and capacitors are factory-selected to assure proper performance.

As is true of the receiver section of the IC-2F, the transmitter meets or exceeds all advertised specs. Operation during a two-month period has been 100 percent trouble-free. The unit is rugged, neat appearing, and small enough to fit into any automobile. . . American or foreign.

This is a 6-channel transceiver, provided one does not wish to transmit "direct" on the repeater output frequency. Direct operation is possible, but, if this is done in addition to normal repeater channelizing, the unit becomes a 3-channel device.

— WICER.

Height: 2-3/4 inches.  
Width: 6 1/4 inches.  
Depth: 7 1/4 inches.  
Weight: 4-3/4 pounds.  
Power Requirements: 13.5 volts dc, negative ground, +1.5 volts. Receive current -125 mA. Transmit current -2.5 A.  
Price Class: \$350.