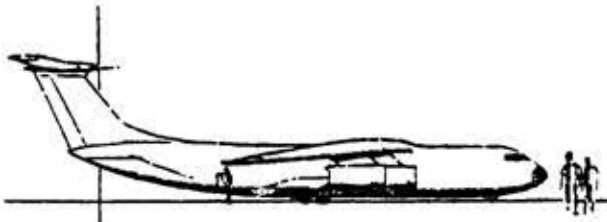


TACAN SYSTEM

GENERAL

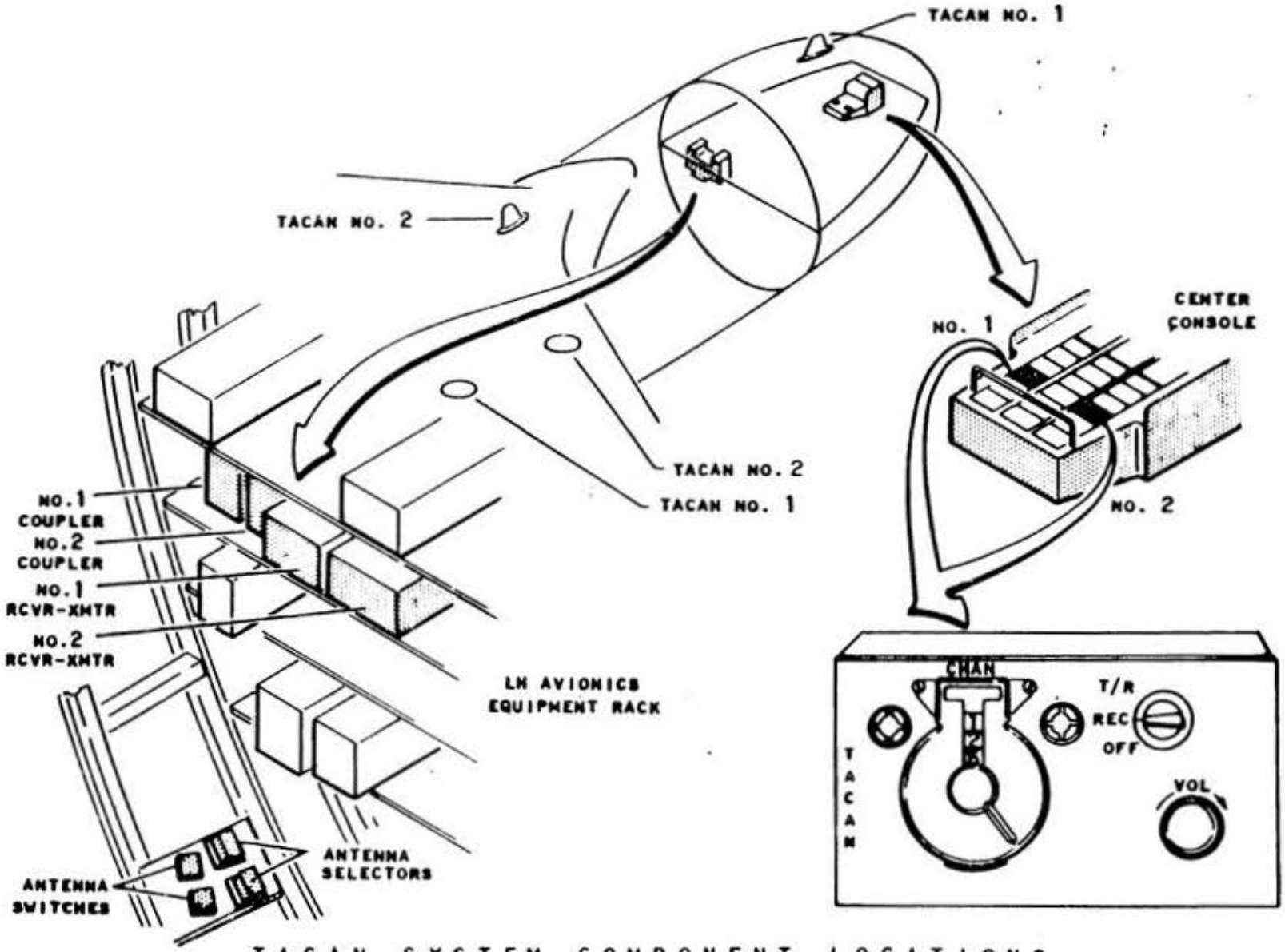
The Tactical Air Navigation (TACAN) systems are used to determine the bearing and distance of a selected surface beacon station from the aircraft. Continuous bearing and distance information is displayed on indicators as a navigational aid, during cross-country flights.

AIRCRAFT INSTALLATION

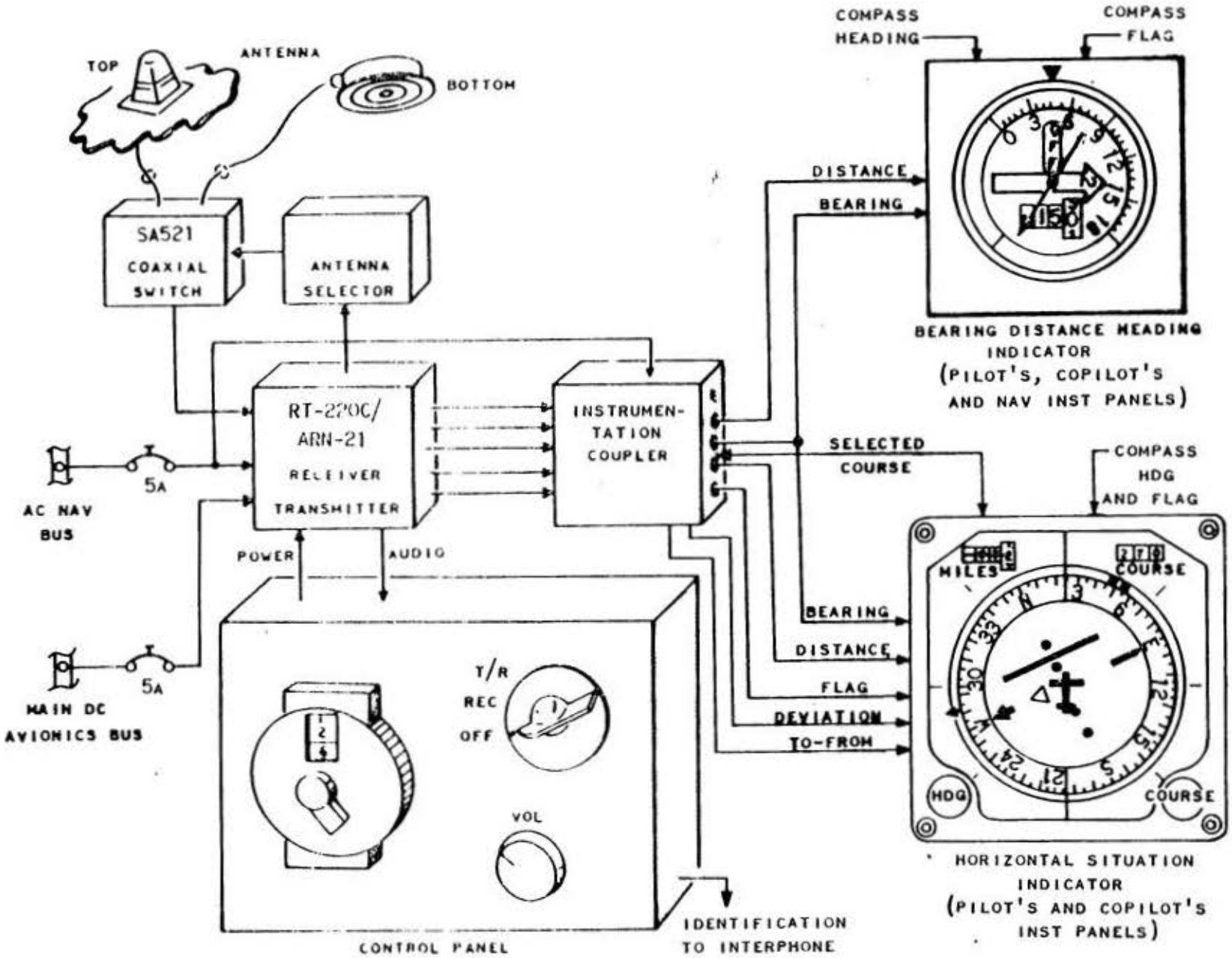
Two complete and independent ARN-21C TACAN systems are installed in the aircraft. Each system includes the following components:

- Receiver-Transmitter
- Control Panel
- Instrumentation Coupler
- Antenna Selector
- Antenna Switch
- Top Antenna
- Bottom Antenna

The Receiver-Transmitter (RT) units and instrumentation couplers are installed in the left-hand avionics equipment rack (underdeck). The antenna selectors and antenna switches are located to the left and slightly aft of the left-hand avionics equipment rack. The control panels are installed in the center console; one is on the pilot's side of the center console and the other is on the copilot's side. A stub-type antenna for each system is mounted on the top centerline of the fuselage. The bottom antenna for each system is flush-mounted on the bottom centerline of the fuselage. 115-volt, A-C power is applied through circuit breakers on the avionics circuit breaker panel. No. 1 TACAN receives A-C power from navigation bus No. 1 and D-C power from the main D-C avionics bus No. 1. The No. 2 TACAN is supplied in an identical manner from the No. 2 buses.



TACAN SYSTEM COMPONENT LOCATIONS



UNIT BLOCK DIAGRAM ARN-21C

SYSTEM OPERATION

The two systems are designated as the No. 1 (pilot's) TACAN and the No. 2 (copilot's) TACAN. The No. 1 TACAN obtains compass reference from the No. 1 C-12 Compass system while the No. 2 TACAN is referenced to the No. 2 C-12 compass. Cross-connection between the two compass systems, through the pilot's and copilot's instrument panels, provide increased reliability in the event of failure in one of the compass systems. The TACAN systems may be selected for use by the flight director systems to provide lateral guidance information. TACAN beam deviation signals may be supplied by the No. 2 TACAN system to the All-Weather Landing System (AWLS) autopilot. Bearing and distance signals may be furnished by the No. 1 TACAN system to provide a source from which the AN/ASN-24 navigational computer may develop ground track information. For each TACAN system there is one top and one bottom antenna. Since aircraft attitude during maneuvers may blank out one of the antennas, an antenna selector monitors the TACAN receiver output and automatically selects the antenna which is receiving adequate signal.

NOTE: For the remainder of this chapter, unless otherwise indicated, only one TACAN system will be discussed, since both systems are identical in composition and operation.

All controls necessary for operation of the system are on the Control Panel. Two rotary switches allow selection of any channel from 1 through 126. Two modes of operation are available: "REC" (receive) and "T/R" (transmit/receive). When "REC" operation is selected, the receiver circuits of the TR unit are energized, and the system provides bearing information. When the "T/R" mode is selected, both receiver and transmitter circuits are energized, and the system provides bearing and distance information. The "VOL" (volume) control varies the audio output to the AN/AIC-18A interphone system.

When the receiver circuits are energized, signals from the beacon station are processed to provide bearing and station identification signals. The bearing signals, transmitted by the beacon station, consist of four modulated components: two 15 Hz (hertz) signals and two 135 Hz signals. One 15 Hz signal has a "fixed" (reference) phase regardless of the bearing of the aircraft to the beacon station. It varies degree-for-degree with the magnetic bearing of the aircraft, with respect to the beacon station. The 15 Hz variable phase is a result of the rotation of the cardioid pattern of the ground station antenna. The 135 Hz signals also consist of a reference phase and a variable phase. The 15 Hz signals provide coarse bearing information, and the 135 Hz signals provide fine bearing information. These bearing signals are applied to reference and variable bearing detectors in the receiver. The reference signals and the variable bearing signals are separated by the detectors and compared in phase comparison circuits.

The phase difference (determined by the position of the aircraft, relative to the beacon station) between the signals is converted into bearing information.

The bearing information is displayed on Bearing-Distance-Heading Indicators (BDHI). There is one BDHI on the pilot's instrument panel, one on the copilot's instrument panel, and two at the navigator's station. BDHI selector panels, on the pilot's and copilot's instrument panels, are used to select the information displayed on their respective BDHI's. Two navigation selector panels enable the pilot and copilot to select TACAN signals for their flight director systems. When TACAN signals are selected for use by the flight director, distance to the beacon station is displayed on Horizontal Situation Indicator (HSI). Two HSI's are provided; one on the pilot's instrument panel, one on the copilot's instrument panel. To fly a TACAN radial, the course arrow of the HSI is manually positioned to the desired TACAN course. The selected course information is compared with the TACAN bearing signals to develop course deviation information. This comparison takes place in the TACAN instrumentation coupler. The course deviation information is displayed by the course deviation indicator of the HSI. Deviation of the indicator in either direction (left or right) shows that the aircraft is not on the selected course, and it must be flown in the direction of the indicator deviation to get on course. The "to-from" indicator of the HSI shows whether the aircraft is flying on a radial toward or away from the beacon station. The deviation indicator alarm flag is used to monitor the reliability of the TACAN signal. When the flag is in view, the information being displayed is unreliable. TACAN bearing is displayed by the HSI bearing pointer when TACAN is selected at the NAVIGATION SELECTOR panel.

The radar principle is used to measure distance. It is based on the constant speed of RF energy as it travels through space.

NOTE: RF energy travels one nautical mile in approximately 6.18 microseconds.

When the "T/R" mode of operation is selected, the RT unit transmits a signal to the ground station. Narrow, widely-spaced interrogation pulses are repeatedly transmitted. These pulses are picked up by the surface beacon and applied to the beacon receiver. The receiver develops a signal which causes the beacon transmitter to send out reply pulses. The reply pulses are picked up by the airborne receiver. Timing circuits in the receiver measure the interval between the original transmission and the reply from the surface beacon. This time interval is converted into distance information.

Distance information is displayed on the navigator's two BDHI's. The No. 1 BDHI displays distance information from the No. 1 TACAN system and the No. 2 BDHI is used with the No. 2 TACAN. The pilot's BDHI displays No. 1 TACAN distance and the copilot's BDHI displays No. 2 TACAN distance. When TACAN signals are selected for use by the flight director systems, distance information is also displayed on the HSI's.

The antenna selection is determined on the basis of a minimum usable signal. When the system is not receiving a usable signal, the antenna selector operates, causing the antenna switch to alternately connect the top and bottom antennas to the receiver. When an antenna which is receiving an adequate signal is connected to the receiver, the receiver applies a signal to the antenna selector unit. This stops the switching action and keeps the selected antenna connected.

SPECIFICATIONS

ARN-21C TACAN

CHARACTERISTIC	SPECIFICATION
Frequency range	962 MHz to 1213 MHz
Low band (channels 1-63)	Transmitter: 1025 MHz to 1087 MHz Receiver: 962 MHz to 1024 MHz (63 MHz below transmitter frequency)
High band (channels 64-126)	Transmitter: 1088 MHz to 1150 MHz Receiver: 1151 MHz to 1213 MHz (63 MHz above transmitter frequency)
Intermediate frequency (IF)	63 MHz ± 70 KHz (transmitter frequency used for receiver injection)
Receiver sensitivity	-90 db triggering level
Transmitter pulse power output	1 KW minimum, 2.5 KW maximum
Pulse pair transmission rate (PRF)	Search: 120 to 150 ppps (varying) Track: 22 to 30 ppps (varying)
Channel selection time	12 seconds maximum

SPECIFICATIONS (continued)

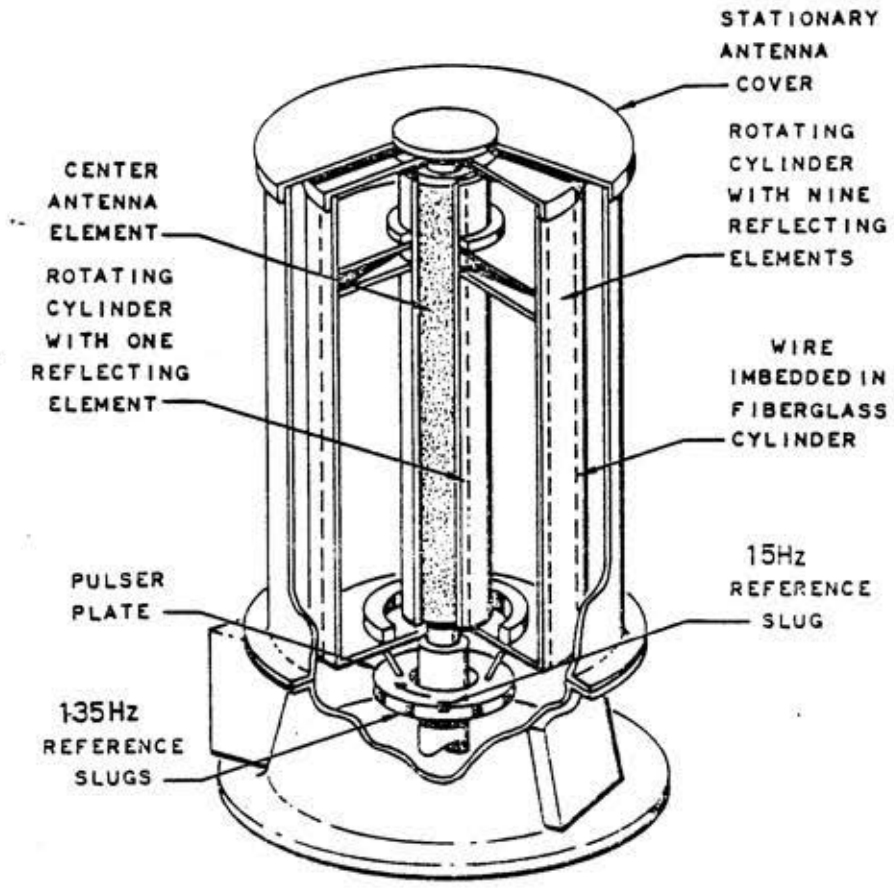
ARN-21C TACAN

CHARACTERISTIC	SPECIFICATION
System accuracy	Azimuth: ± 0.5 degree Range: ± 0.1 nautical mile plus 0.2 percent of distance
Beacon identity tone	Morse coded audio tone at 1350 Hz
Operating range	195 nautical miles at 40,000 feet
Power requirements	115 volts, AC, 380-1000 Hz, single phase 115 volts, AC, 380-420 Hz, single phase 28 volts, DC

BLOCK DIAGRAM THEORY OF OPERATION

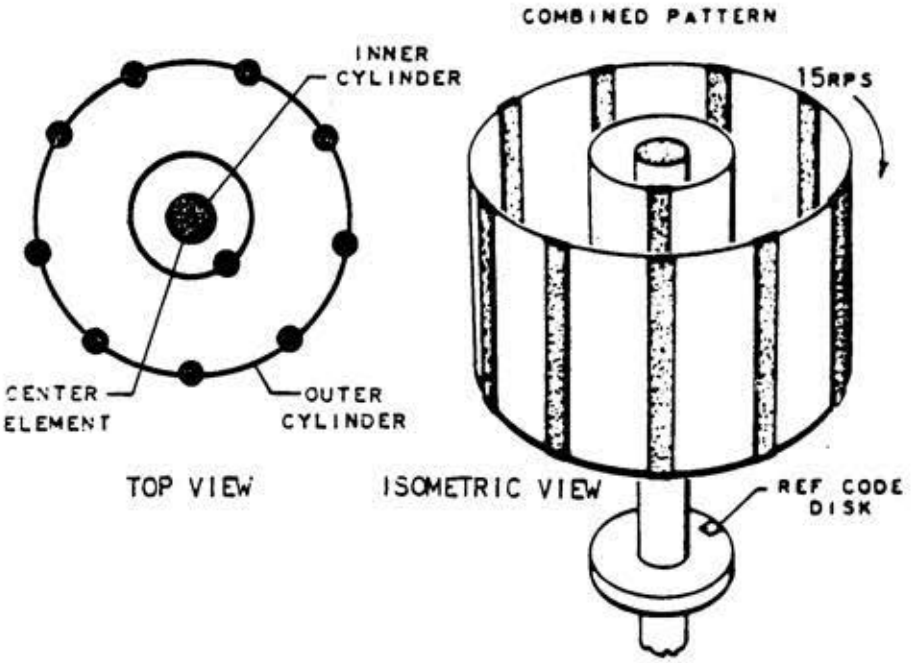
BEACON OPERATION

The surface beacon station is a pulsed transmitter-receiver system. Approximately 3,600 paired pulses per second are transmitted. Approximately 25 per cent of these pulse-pairs are used as reference bearing signals. The remaining pulses are randomly-spaced filler pulses and distance reply pulses in a ratio determined by the number of aircraft interrogating the beacon. The surface beacon also transmits an identification signal at 37.5 second intervals. This signal is keyed with three international Morse code characters, configured to provide a three-letter identification of the surface beacon. The transmitter is capable of responding to interrogations from as many as 120 airborne systems simultaneously. When distance information is desired, interrogation pulses are sent out by the airborne transmitter. This interrogation is detected by the surface beacon and used to trigger the beacon transmitter. Some of the random pulse-pairs are now synchronized with the interrogation pulses. These synchronized pulses are called reply pulses. The airborne receiver measures the time between the interrogation and the reply. This interval is converted into distance information.



TYPICAL GROUND BEACON ANTENNA

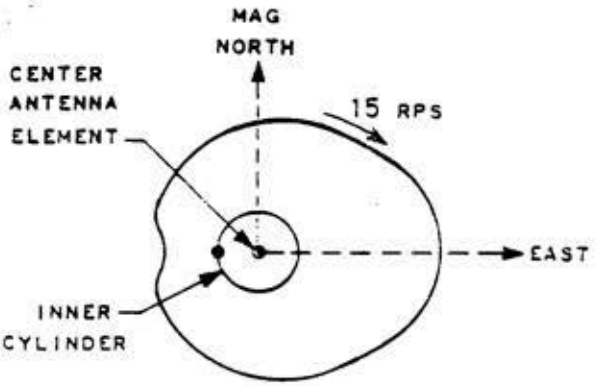
The surface beacon station antenna has four major parts: a center element, surrounded by an inner and an outer fiberglass cylinder, and a pulser plate. These components develop a directional radiation pattern. The center element is excited by the RF energy from the transmitter. This element is stationary and is omni-directional in the horizontal plane. Around the element is the inner fiberglass cylinder which has a vertical conductive wire embedded in the fiberglass. This wire acts as a reflector to distort the normal radiation pattern into a cardioid. The cylinder is rotated at 15 revolutions per second to cause the entire cardioid pattern to rotate. As a result of the pattern rotation, the signal received in any direction from the beacon will have sinusoidal variations in strength as a function of time. The signal received by the airborne system will vary in amplitude at a 15 Hz rate. This equals one cycle for each antenna revolution. For each degree of geographic bearing change, there is a one degree change in the electrical phase of the 15 Hz variable phase signal. The phase of the signal is used to develop coarse bearing information. It is necessary to have a fixed reference of the same frequency for phase measurement.



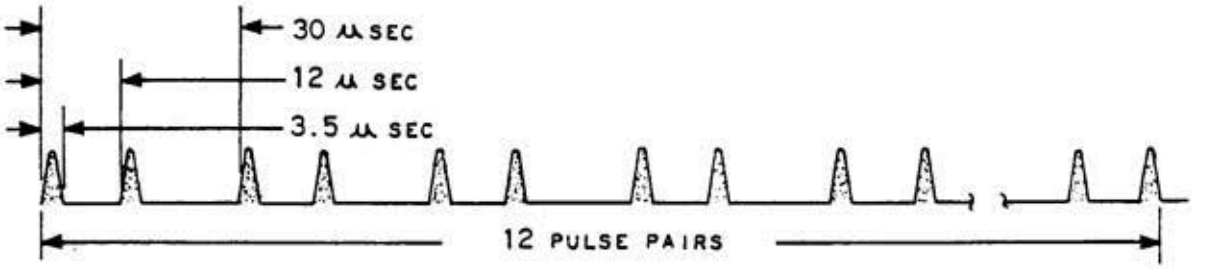
GROUND BEACON ANTENNA

The fixed reference must be received in all directions around the beacon with identical phase. Therefore, each time the maximum point of the cardioid pattern passes through "east" (referenced to a magnetic compass), a series of pulses is transmitted. This is the reference phase 15 Hz signal. This signal is commonly referred to as the Main Reference Burst (MRB).

The variable phase 15 Hz signal and the MRB are compared in the airborne receiver to form the coarse bearing signal of the TACAN system.



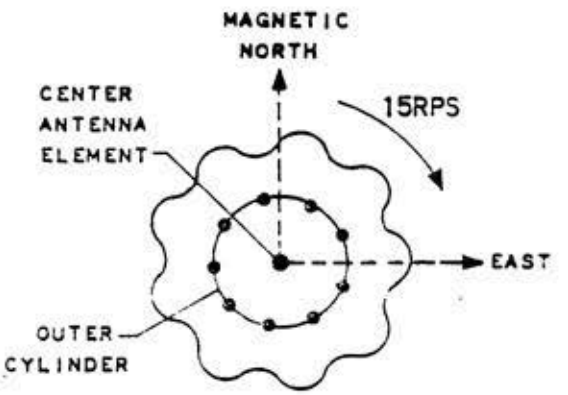
15Hz PATTERN



15Hz REFERENCE CODE GROUP

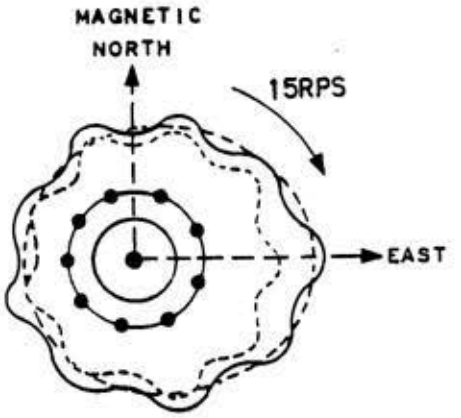
FINE BEARING INFORMATION

A fine bearing feature is used to produce greater accuracy than is possible with the cardioid antenna pattern system. The outer cylinder of the surface beacon antenna is used to produce the fine bearing signal. The cylinder has nine vertical conductive wires embedded in the fiberglass. These wires are spaced uniformly at 40 degree intervals. The wires distort the cardioid pattern. The resulting composite pattern maintains the overall cardioid variation pattern resulting in sinusoidal variation in amplitude of the received signal in any direction from the beacon transmitter. The received signal has the basic 15 Hz amplitude variation as before. The nine minor lobes produce nine cycles of amplitude variation with each antenna revolution. Since the pattern rotates at 15 revolutions per second, the nine lobes produce a 135 Hz signal (15 x 9 = 135). To furnish a reference phase for the 135 Hz component, another series of coded pulses - the Auxiliary Reference Burst (ARB) - is transmitted. The ARB's are spaced 40 degrees apart. The first ARB appears 40 degrees after the maximum point of the antenna radiation pattern rotates past east. Comparing the ARB's and the 135 Hz variable bearing signals provides fine bearing information. In a 40 degree arc of bearing, which is the width of a minor lobe, the phase of the received 135 Hz signal will vary through a complete cycle of 360 degrees.



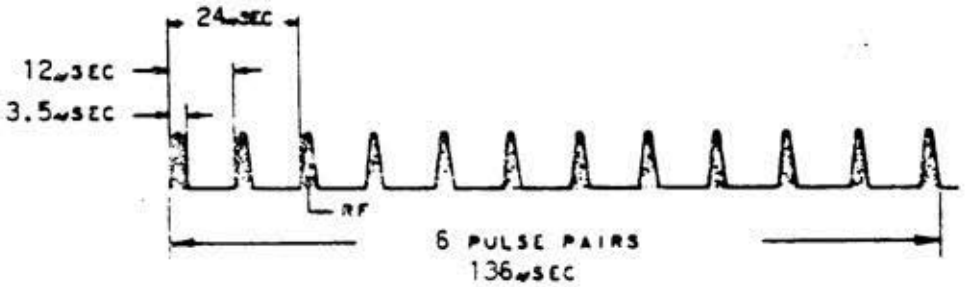
135Hz PATTERN
FINE BEARING
INFORMATION

Thus each degree of bearing change results in a nine degree change in the phase of the 135 Hz signal. The ratio of nine electrical degrees to one rotational degree gives a pronounced magnifying effect in the process of detecting changes in bearing.



COMBINED PATTERN

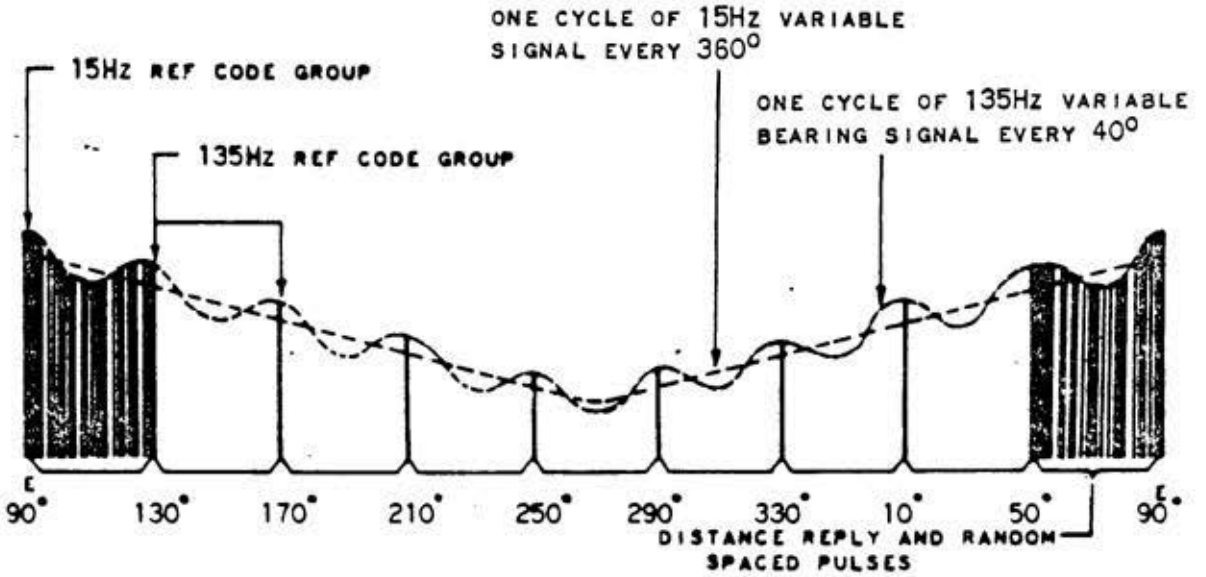
The MRB's and ARB's are controlled by the pulser plate (reference code disc) on the surface beacon antenna assembly. The plate consists of a rotary aluminum disc with soft iron slugs embedded in the outer edge. The disc rotates at 15 revolutions per second. The slugs pass through a pickup coil, producing two sets of voltage (trigger) pulses. One pulse occurs once for each 360 degrees of disc rotation; the other occurs at 40 degree intervals thereafter. These pulses are synchronized with the 15 Hz and 135 Hz modulation components, and are used to trigger the transmitter which generates the



135 Hz REFERENCE CODE GROUP

MRB's and ARB's. The MRB's and ARB's have priority over distance reply, identification, and randomly-spaced filler pulses.

The Receiver and Transmitter have the same frequency selection system, tunable to any of the 126 channel frequencies. These channels are spaced one Megahertz (MHz) apart. The transmitter operates in the frequency range of 1,025 through 1,150 MHz with a peak pulse power output between 1.0 and 2.5 kilowatts. The receiver operates from 962 through 1,024 MHz in low band and from 1,151 through 1,213 MHz in high band. The receiver frequency is 63 MHz below the transmitter frequency for low band (channels 1-63) operation and 63 MHz above the transmitter frequency for high band (channels 64-126) operation. This

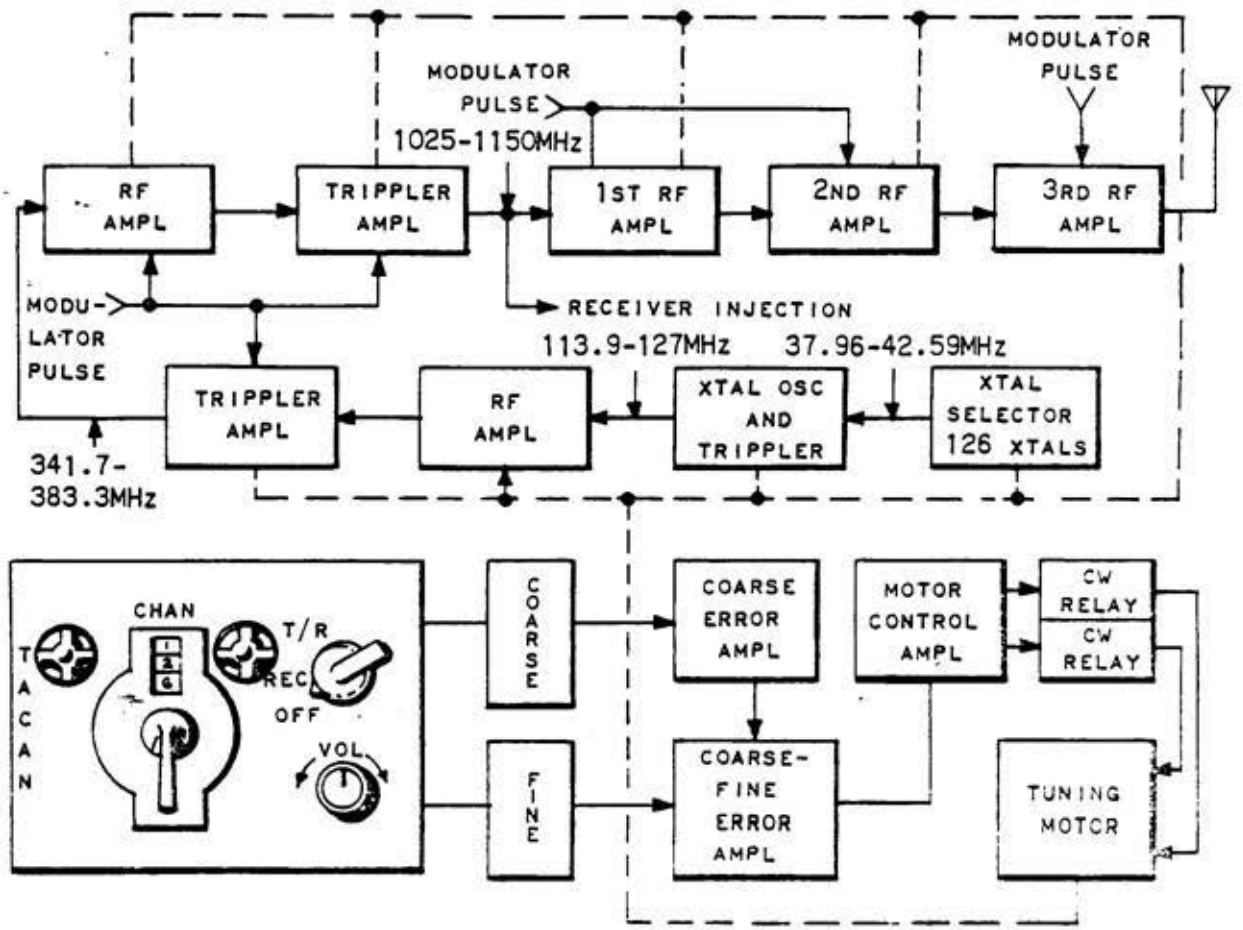


COMPOSITE RECEIVED SIGNAL WITH AIRCRAFT DIRECTLY EAST OF GROUND STATION

enables the transmitter frequency to be used as the local oscillator frequency for the receiver. Operating frequencies are developed from a crystal-controlled oscillator. The oscillator output is multiplied in frequency by a factor of 27 to develop a signal for transmitter excitation and receiver oscillator voltage.

CHANNEL SELECTION

Channel selection is accomplished by selecting the proper oscillator crystal and tuning all of the RF circuits to accept the operating frequency. Channel selection is controlled by two balanced-bridge servo loops. One bridge is composed of a precision-resistive-network, connected across a coarse frequency selector switch in the control panel, and a potentiometer located in the RT unit. The fine frequency selector switch is part of a similar bridge circuit. Selecting a new frequency on the control panel unbalances one or both of the bridge circuits. A voltage appears across the bridge, providing an input signal to the servo amplifier which causes the tuning servo motor to drive. The motor adjusts the potentiometers in the RT unit to balance the bridge. The motor also positions the tuning mechanism to select the necessary oscillator crystal and tune the RF circuits to accept the selected frequency. The coarse bridge error causes the tuning mechanism to drive to within 10 channels of the desired frequency; then the fine bridge error drives the tuning mechanism to the selected channel.



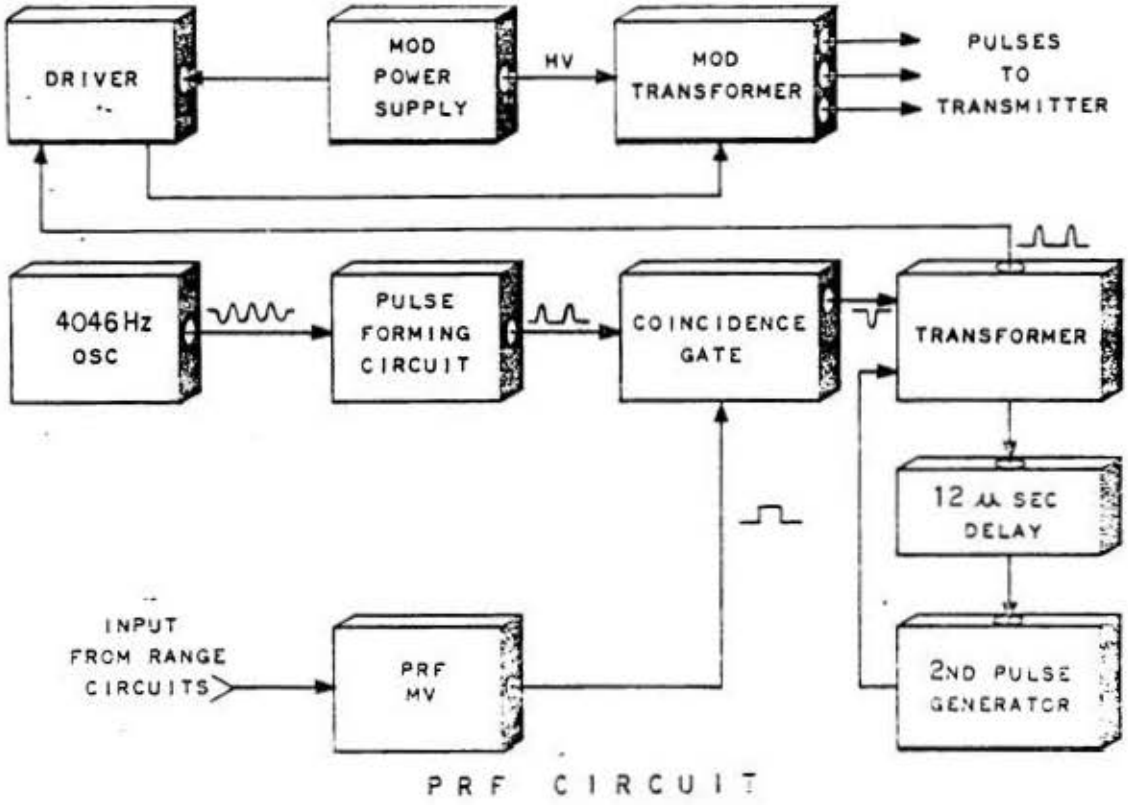
FREQUENCY GENERATION

When the control panel frequency is changed by as much as 10 channels, a coarse error results. The signal is amplified by the coarse error amplifier and applied to the coarse-fine error amplifier. Any fine bridge error signal is also applied to the coarse-fine error amplifier. The output of this stage is applied to a motor control amplifier. The amplifier operates either a Clockwise (CW) or a Counter-Clockwise (CCW) relay. The relays determine in which direction the tuning motor will drive. As the motor drives, both tuning bridges will balance. As balance occurs, the error signal decreases to zero and the motor stops. Tuning is now complete.

RANGE CIRCUITS-TRANSMITTER

The frequency multiplier and transmitter-preselector subassemblies contain the circuits which generate and amplify the desired RF output. The frequency multiplier contains the crystal oscillator and two frequency tripler circuits. The oscillator operates at the frequency of the crystal selected by the tuning system.

There are 126 crystals which operate in the range of 37.96 - 42.59 MHz. The oscillator output frequency is multiplied in the two tripler circuits, providing



PRF CIRCUIT

a signal to the transmitter ranging from 341.7 - 383.3 MHz. Within the preselector, a tripler-amplifier develops the transmitter output in the frequency range of 1,025 - 1,150 MHz. A portion of this signal is applied for receiver injection. In "T/R" operation, high voltage pulse pairs are applied to the RF circuits. These pulses are developed by the modulator circuits to enable the transmitter to develop sufficient RF power output. The short bursts of RF energy, provided by the transmitter, are the interrogation pulses for the surface beacon station.

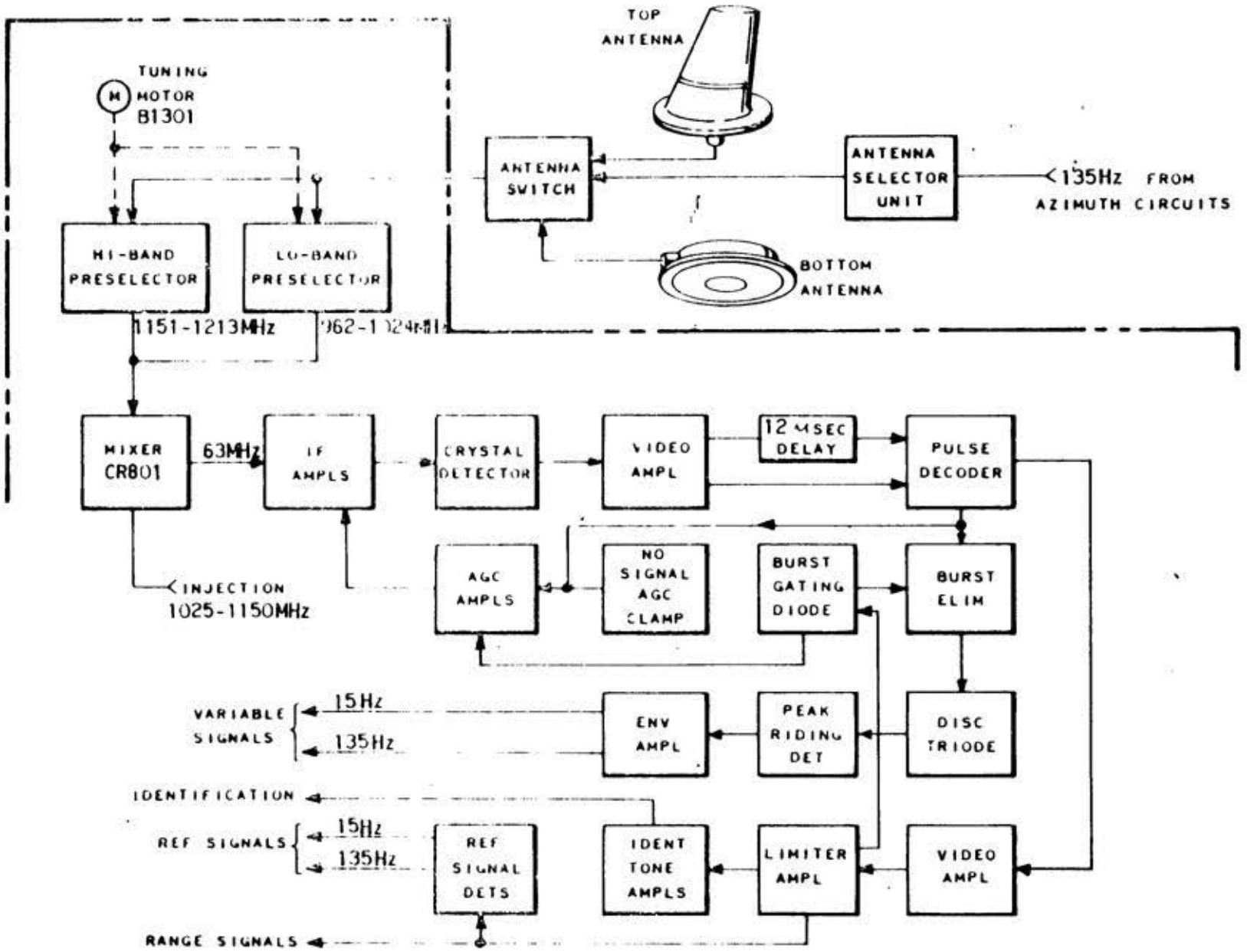
The time reference for the interrogation is a crystal-controlled oscillator which generates a 4,046 Hz sine wave. The time of one complete sine wave is equivalent to 20 radar miles. A sharp pulse is generated from each cycle of the 4,046 Hz sine wave by a pulse generator circuit. These pulses are applied to a coincidence gate where a lower frequency pulse is generated. The Pulse Repetition Frequency (PRF) is permitted to vary (within limits) in an irregular or random manner. This is achieved by employing a non-stable multivibrator to control the output of the coincidence gate. When the 4,046 Hz pulse and the multivibrator gating pulse are coincident, the coincidence gate provides an output pulse. These pulses, which are time-coincident with one of the 4,046 Hz

timing pulses, establish the repetition rate of the modulator trigger and the interrogation pulses. The modulator trigger pulse is coded by a 12 microsecond delay line and a second pulse generator to supply a second pulse for each input from the coincidence gate. The modulator, therefore, receives two pulses which are 12 microseconds apart. These pulses trigger the modulator circuits to supply the high voltage required for transmitter operation. The transmitter radiates pulses of RF energy, 3.5 microseconds wide. These pulses are transmitted in pairs, spaced 12 microseconds apart. After the transmission of each pulse pair, time is allotted for the surface beacon station reply.

RANGE CIRCUITS-RECEIVER

The received replies from the surface beacon station are applied to the receiver preselector, which consists of four tuned RF cavities arranged in pairs. One pair is used for low band reception and the other pair is for high band. The channel selection circuits tune the cavities and select which pair is to be used. The output of the preselector is applied to a mixer, where the RF signal is combined with an injection signal (1,025 - 1,150 MHz) from the transmitter circuits. The difference frequency of 63 MHz is applied to a six IF amplifier stage. The output of this stage is applied to a crystal diode detector circuit which removes the IF component of the signal. The detected pulse output is applied directly to a pulse decoder and through a 12 microsecond delay line to the pulse decoder. When properly spaced pulses are applied, the pulse decoder develops a video pulse for each pulse pair. The video pulse coincides with the second pulse in the pulse pair. The decoder output is amplified and applied to identification, bearing, and range circuits.

The range circuits must search for, find, and track the beacon distance reply pulses which correspond to an interrogation. These reply pulses arrive at a certain fixed time after each interrogation, corresponding to the distance between the aircraft and the surface beacon. The tracking circuits are inoperative at all times except during a time interval centering around the arrival of the correct reply pulses. In this way, the tracking circuits can ignore the reply pulses of other aircraft interrogating the surface beacon. This is accomplished by generating gates to coincide with the reply pulse arrival. When the system is first turned on and a surface beacon station selected, the system has no way of predicting when reply pulses will arrive. Therefore, it must search for the correct reply pulses. The pulse which triggers the modulator and causes the transmitter to interrogate the surface beacon is also used to start a variable-width gate. The width of the gate is made to progressively increase (search) with each interrogation. The trailing edge of the gate is used to start a selector pulse. As the system searches, the selector pulse is progressively delayed to effectively lengthen the search distance. This process continues until a delay corresponding to the surface beacon distance is produced. At this time, the reply pulses and the selector gate will coincide, and the circuits will assume the "track" mode of operation. The position of the selector gate will then be

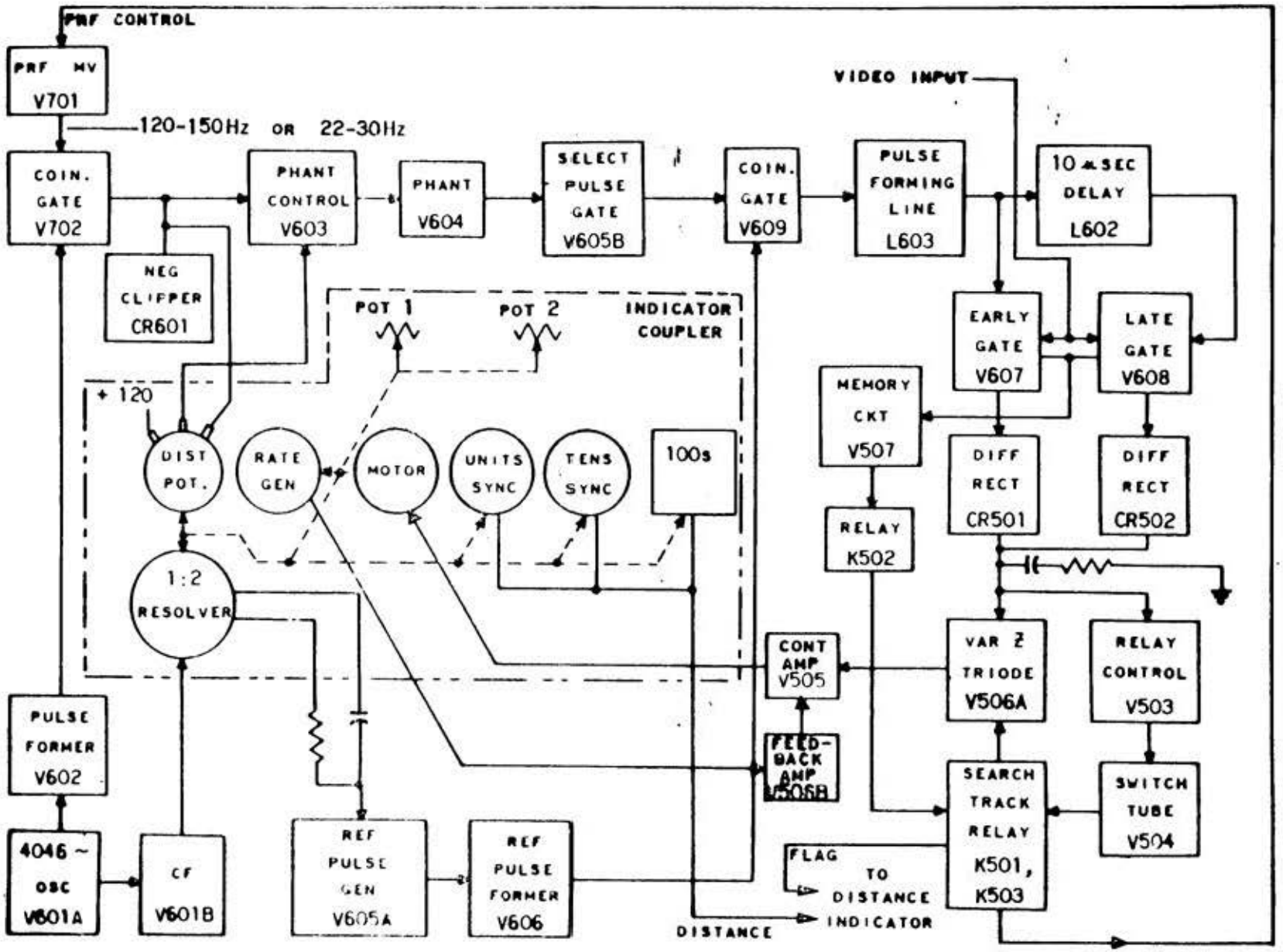


TACAN RECEIVER BLOCK DIAGRAM

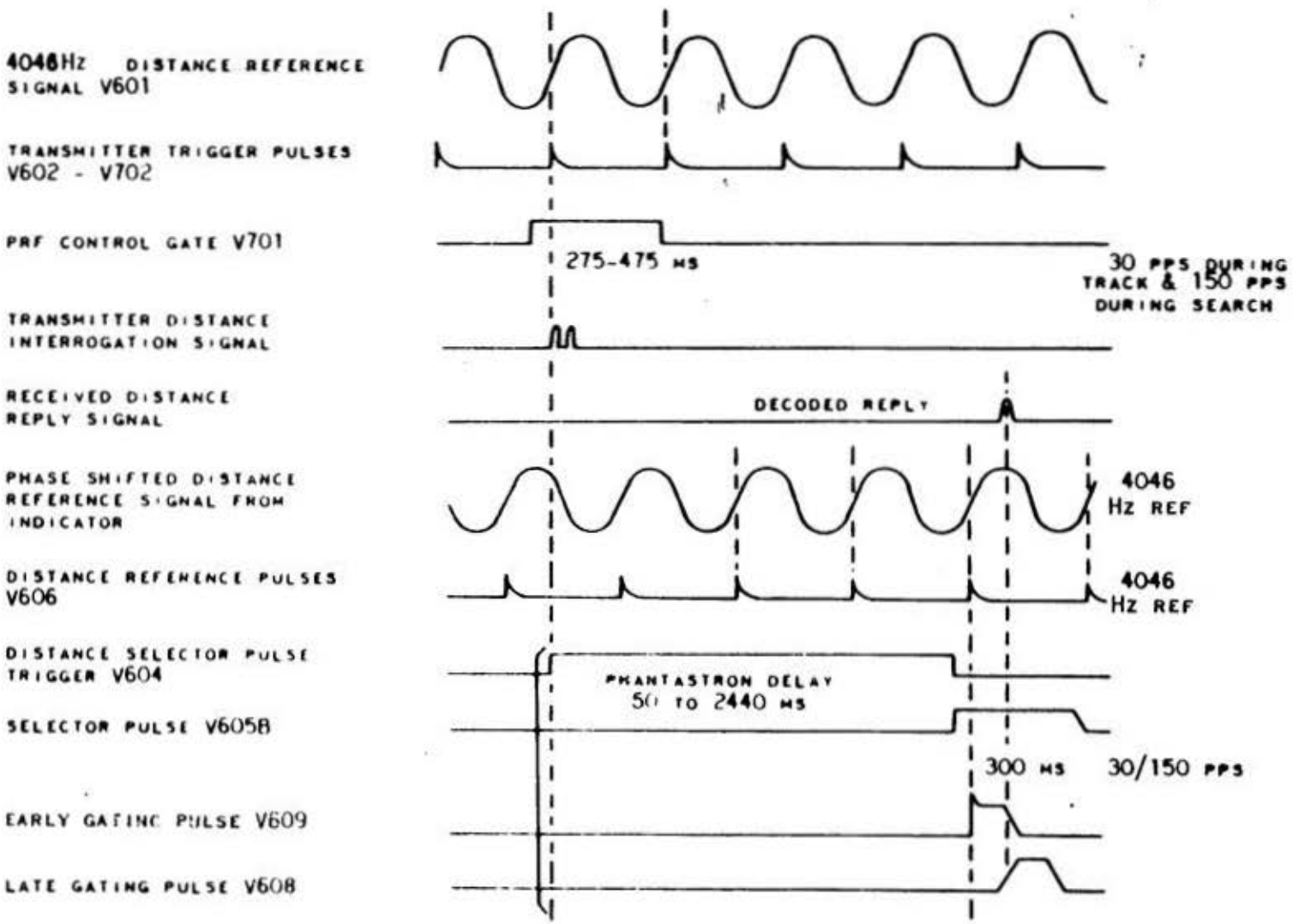
controlled by circuits which compare coincidence of the reply pulse and the gates. The gate will thereby be made to coincide with the reply pulse for the duration of the track mode.

In the range circuits, a signal from the 4,046 Hz reference oscillator is applied to the rotor of the range resolver in the instrumentation coupler. The phase-shifted output from the resolver is used to develop a reference pulse for each sine wave cycle. These pulses appear 20 nautical miles apart. One revolution of the resolver produces a change in range of 20 miles. These reference pulses are applied to a coincidence gate to be compared in time with the selector gate signal. To develop the selector gate, a timing pulse from the modulator is applied to a phantastron. The modulator pulse causes the phantastron to generate a range gate. A distance potentiometer, located in the instrumentation coupler, applies bias to the phantastron to determine the width of the gate. One revolution of the potentiometer produces a 200 mile change in range. When the range resolver and the distance potentiometer are set to zero, the duration of the range gate is 50 microseconds. When the indicated range is 195 miles, the range gate duration is 2,400 microseconds. A 50 microsecond gate is required at zero range because an intentional 50 microsecond delay is introduced at the surface beacon station between distance interrogation pulses and distance reply pulses. The range gate is applied to the selector gate generator. A selector gate is produced by the trailing edge of the range gate. The selector gate and the 4,046 Hz reference pulses are applied to the coincidence gate.

The first reference pulse occuring within the selector gate will produce a 12 microsecond pulse in the output of the coincidence gate. This pulse is applied directly to the early gate stage and, through a 10 microsecond delay line, to the late gate stage. These stages are gated on for approximately 12 microseconds each. Video pulses (distance reply pulses) from the receiver are also applied to these stages. Since the combined "on" time of the two gates is 24 microseconds, the tracking circuits function to accept reply pulses from an area approximately 2 miles wide. In "search" operation, the range resolver and the distance potentiometer are being driven to cause the gate signals to be progressively delayed after each interrogation. This action causes the tracking circuits to



SIMPLIFIED RANGE CIRCUITS



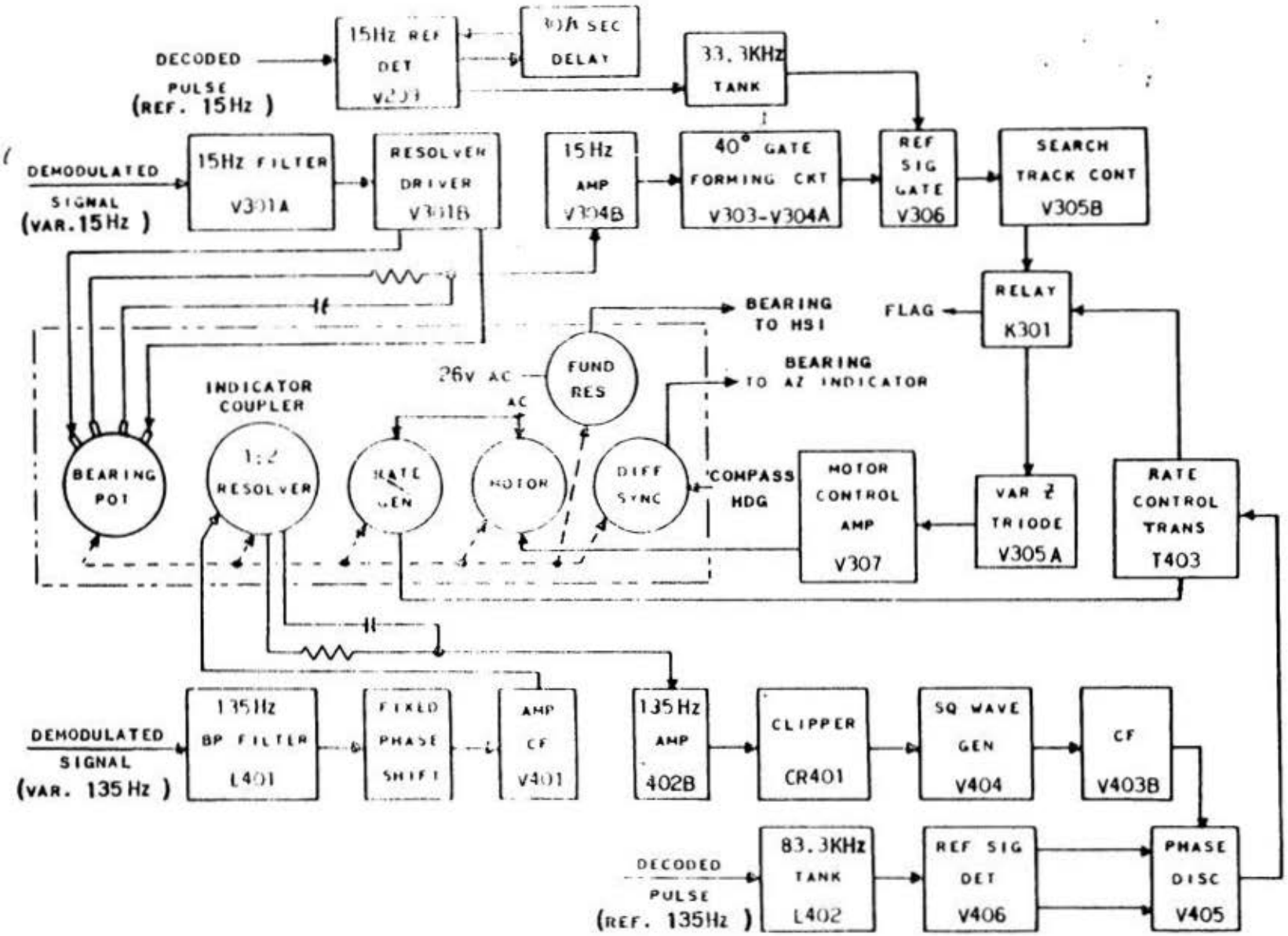
RANGE CIRCUITS, WAVEFORMS

continuously "step out" in range until distance reply pulses fall within the gating time interval. When the video pulses occur midway between the early and late gate pulses, both stages conduct simultaneously. Their outputs are rectified and connected to produce an output of zero. When the video pulses are coincident with either the early or late gate, a polarized D-C output will be developed. The polarized output is amplified and used to control the servo motor. As the motor drives, the range resolver and distance potentiometer are rotated to change the gating circuits and center the early and late gate stages to keep the system in track operation when reply pulses are momemtarily lost. When the gating circuits lose their output for a period greater than 10 seconds, the memory circuit causes a relay to switch the circuits back to search operation. It also causes the distance indicator warning flag to cover the distance indicators when the system is searching.

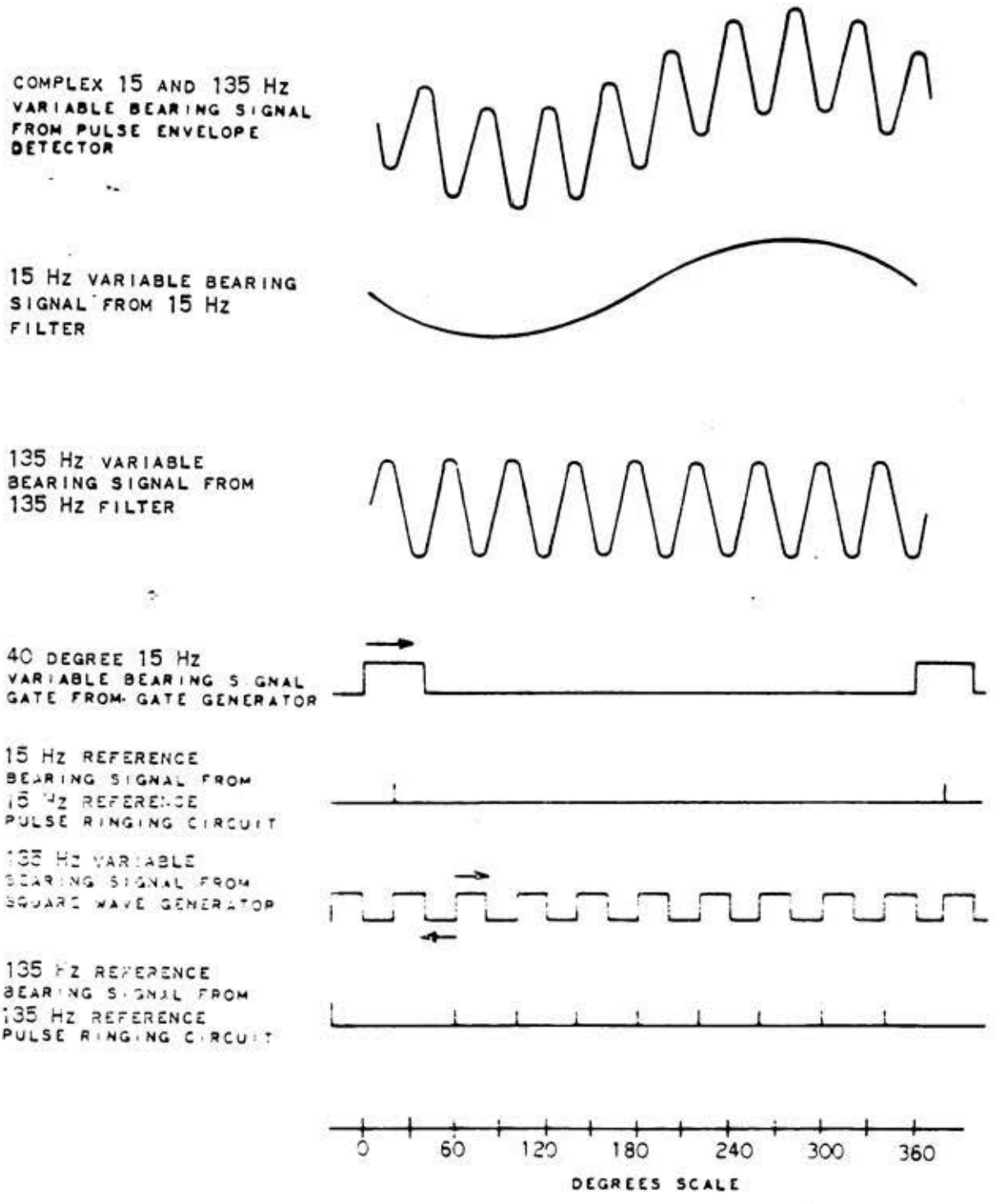
AZIMUTH CIRCUITS

Two types of bearing signals are applied to the bearing circuits. The coarse and fine reference bearing signals (15 Hz and 135 Hz) are applied to a limiter stage to remove amplitude variations. Removing amplitude variations removes any variable bearing signal. The composite coarse and fine variable bearing signals are also supplied a burst eliminator which removes any reference bearing signal components. The output of the burst eliminator is applied to a peak riding detector circuit where amplitude variations are detected to provide an output containing 15 Hz and 135 Hz amplitude variations. This composite signal is applied to two filters where the 15 Hz and 135 Hz components are separated. The 15 Hz (coarse) signal is shifted in phase by a bearing potentiometer in the instrumentation coupler. The 135 Hz (fine) signal is shifted in phase by a bearing resolver in the instrumentation coupler. The two signals are then compared with the reference bearing signals. The coarse signals are compared in the reference signal gate and the fine signals are compared in the phase discriminator. The phase shifted 15 Hz variable bearing signal is used to produce a 40 degree gate. In search operation, the bearing circuits are continuously being driven and the 40 degree gate is continuously being shifted until the gate and the 15 Hz reference bearing signal coincide. At coincidence, the indicated bearing is within 20 degrees of the actual aircraft bearing.

When the 15 Hz reference signal is coincident with the 40 degree gate, the reference signal gate stage provides a signal to actuate the search-track relay. The relay transfers control of the indicator bearing servo loop to the phase discriminator which is controlled by the fine bearing signals. Square waves are produced from the 135 Hz variable bearing signal and applied to the phase discriminator. When the two signals are not properly in phase, the discriminator develops a polarized error signal. The error signal is amplified and used to drive the bearing servo motor. As the motor drives, the 135 Hz variable bearing signal is shifted in phase by the bearing resolver to bring the variable bearing signal and the reference bearing signal into the proper phase relationship.



SIMPLIFIED AZIMUTH CIRCUITS



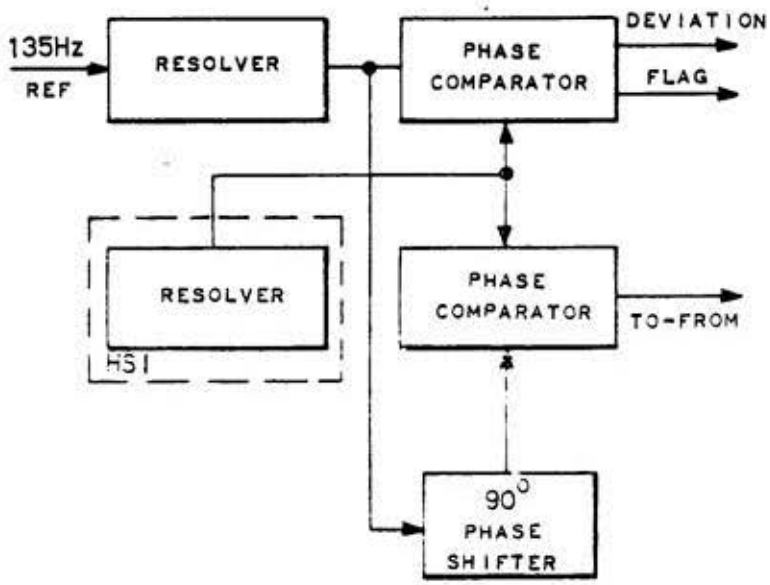
AZIMUTH CIRCUITS, WAVEFORMS

As this occurs, the discriminator output decreases to zero and the bearing servo motor stops. The phase shift necessary to maintain this coincidence is measured by a synchro transmitter to provide an accurate indication of the ground beacon station bearing.

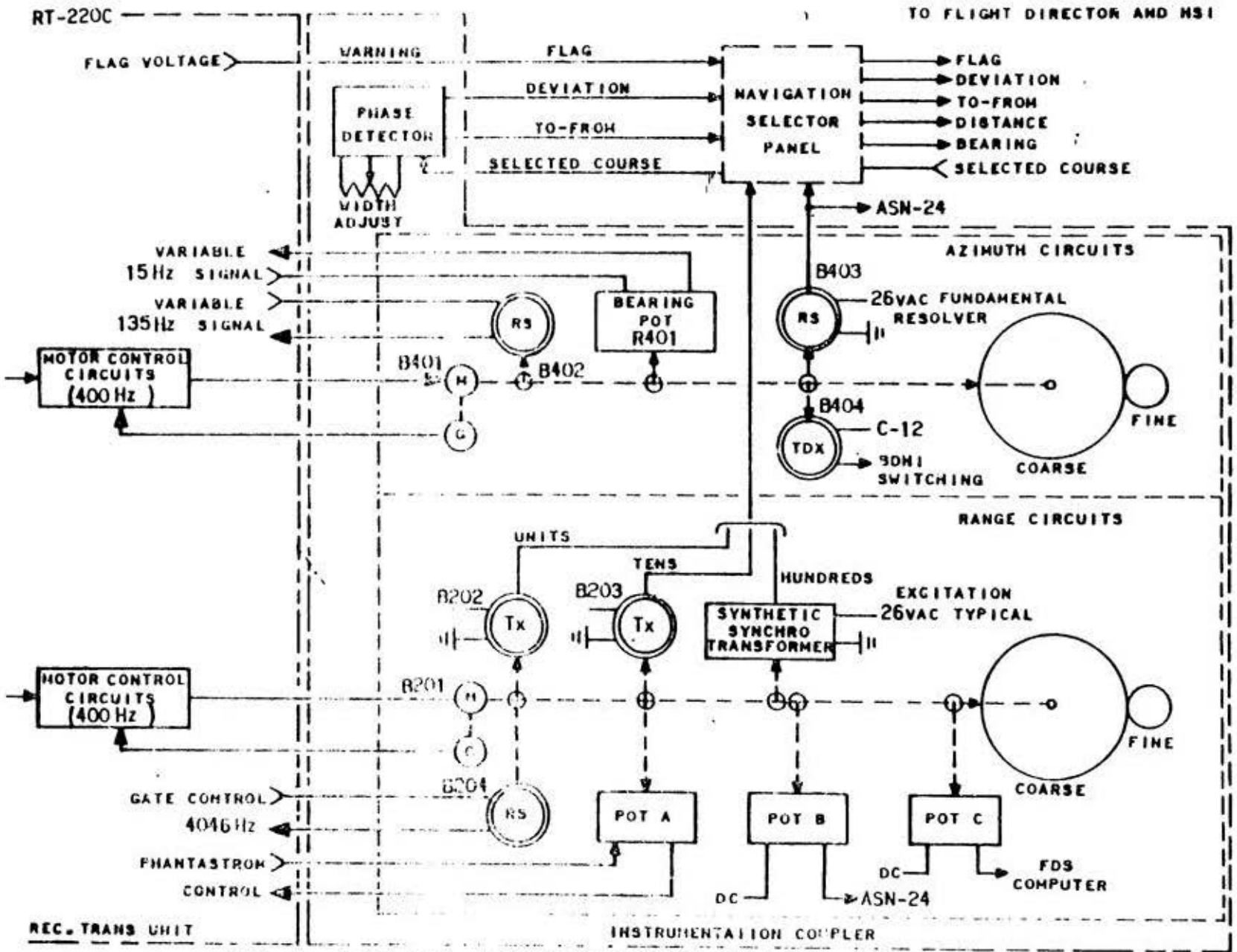
INSTRUMENTATION COUPLER

The instrumentation coupler receives all range and bearing information signals from the TACAN RT unit and distributes them to the BDHI's and HSI's. Bearing, distance, and distance flag signals are fed directly to the appropriate BDHI's. No. 1 instrumentation coupler outputs are sent to the pilot's BDHI and the navigator's No. 1 BDHI. No. 2 instrumentation coupler outputs go to the copilot's BDHI and the navigator's No. 2 BDHI. TACAN outputs are also provided by the No. 1 instrumentation coupler for use by the AN/ASN-24 navigational computer. These outputs consist of distance and bearing information. In addition, outputs of the No. 2 instrumentation coupler are provided for use by the AWLS autopilot system.

A bearing resolver within the instrumentation coupler is used in conjunction with a resolver in the HSI to provide deviation and to-from signals. The resolver in the instrumentation coupler is positioned as a function of TACAN bearing, while the HSI resolver is positioned as a function of selected course. Both resolvers are connected to deviation and to-from detector circuits in the instrumentation coupler. These circuits measure any existing difference between the selected course and the actual course. When the two signals do not agree, the deviation circuits develop a D-C voltage which is applied to the course deviation indicator of the HSI. This indicator presents lateral deviation of the aircraft to the right or left of the desired course. It also presents the desired track; when the deviation bar is to the left of center, the aircraft is right of the selected course.



TO-FROM AND DEVIATION BLOCK DIAGRAM



NO. 1 TACAN INSTRUMENTATION COUPLER

NO. 1 TACAN OUTPUT DISTRIBUTION

The instrumentation coupler also provides a signal to the to-from indicator of the HSI and reliability signals to the deviation warning flag.

SYSTEM PECULLARITIES

Although the channel selector switches on the control panel do not give an indication of channel frequencies, it is always possible to compute both the transmitter and receiver frequencies for any selected channel. Since there are 126 selectable channels which increase from 1 - 126 in 1 MHz steps, knowing the transmitter frequency for only channel 1 will suffice for computing the frequencies of any other channel. Example: the channel 1 transmitter frequency is 1025 MHz. To compute the transmitter frequency for channel 39, merely add 38 MHz to the channel 1 frequency (1025 plus 38 = 1063 MHz). To find the channel 119 transmitter frequency, add 118 MHz to the channel 1 frequency (1025 plus 118 = 1143 MHz).

In computing the receiver frequencies, it must be remembered that the receiver operates in two bands. Channels 1 - 63 use the low band input; channels 64 - 126 use high band. In low band, the receiver frequency can be determined by subtracting 63 MHz (IF) from the transmitter frequency. Example: channel 39 transmitter frequency minus IF equals receiver frequency (1063 minus 63 = 1000 MHz). In high band, the receiver frequency is computed by adding 63 MHz (IF) to the transmitter frequency. Example: channel 122 transmitter frequency plus IF equals receiver frequency (1143 plus 63 = 1206 MHz).