Rockwell International

479S-6A VOR/ILS Signal Generator

operation

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table of contents

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	15 Sep 85
*List of Effective Pages	15 Sep 85
*1	15 Sep 85
2 thru 7	1 Sep 78
*8	15 Sep 85
9 thru 20	1 Sep 78
20A thru 20B	15 Oct 80
21	15 Oct 80
22 thru 28	1 Sep 78
29	15 Oct 80
30	1 Sep 78
*31	15 Sep 85
32 thru 42	15 Oct 80

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

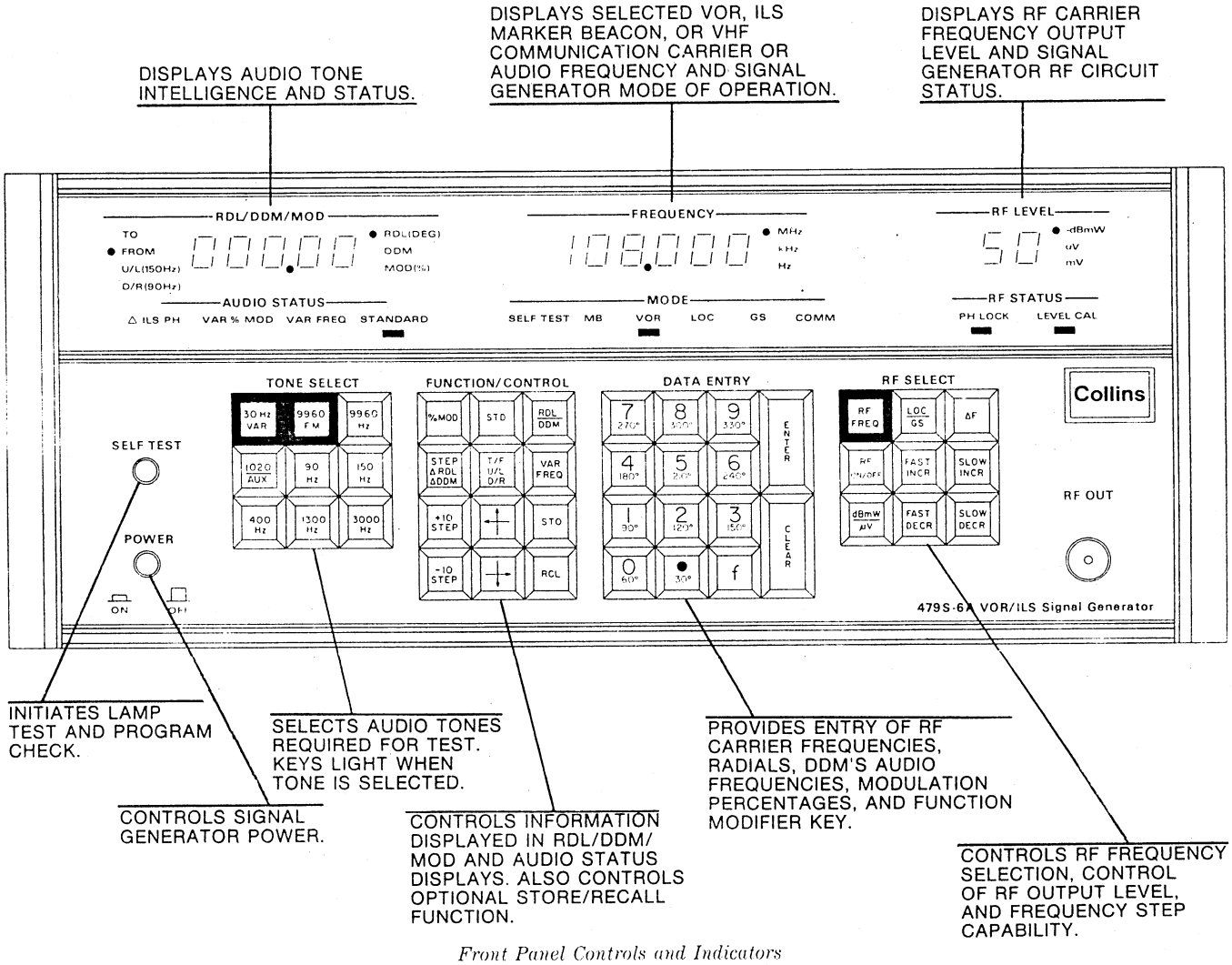
REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	1 Sep 78		None				
1	15 Oct 80		1 thru 10				
2	15 Sep 85		None				

1. INTRODUCTION

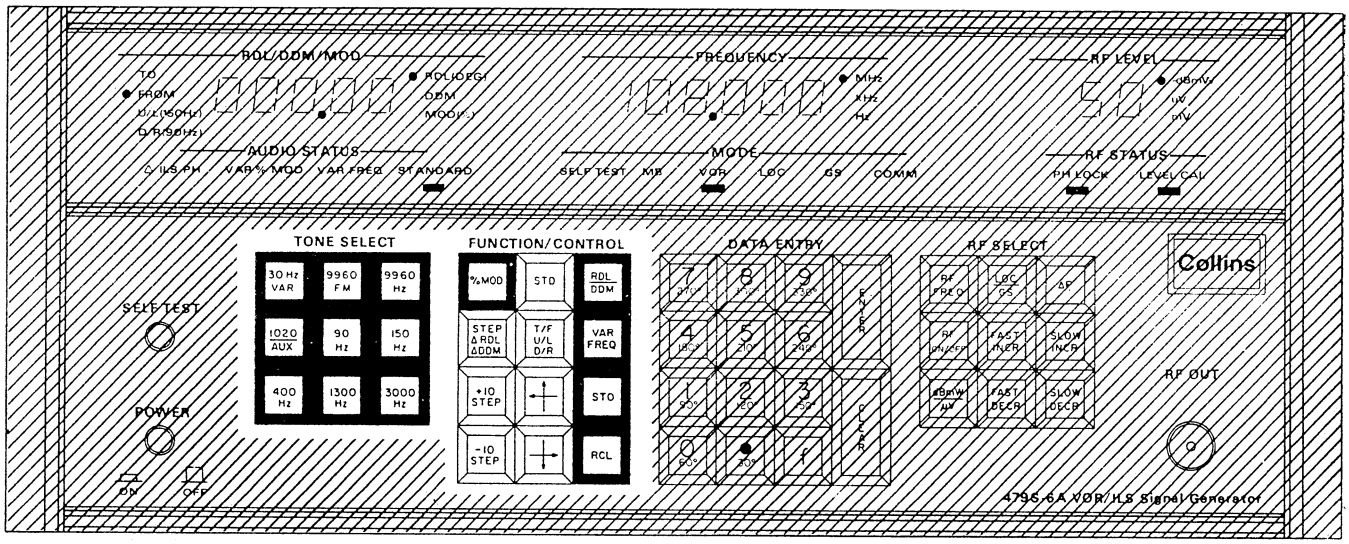
This section provides the instructions for operating the 479S-6A VOR/ILS Signal Generator. The signal generator produces both rf and audio signals required for testing VOR, ILS, marker beacon, and vhf communication receivers. The signal generator switches to the correct mode and preset conditions with the selection of a VOR, ILS, marker beacon, or vhf communication rf frequency. The signal generator is capable of operating on 115 V ac, 50/60 Hz, or 230 V ac, 50/60 Hz. The generator is shipped from the factory wired for 115-V ac operation. If 230-V ac operation is required, refer to paragraph 7 of the description section.

2. CONTROLS AND INDICATORS

Figure 1 is an illustration of the 479S-6A front panel with a brief description of each functional area. Figure 2 illustrates and tables 1 through 7 describe the controls and indicators in each of the major functional areas.



Front Panel Controls and Indicators
Figure 1



Controls and Indicators
Figure 2 (Sheet 1 of 4)

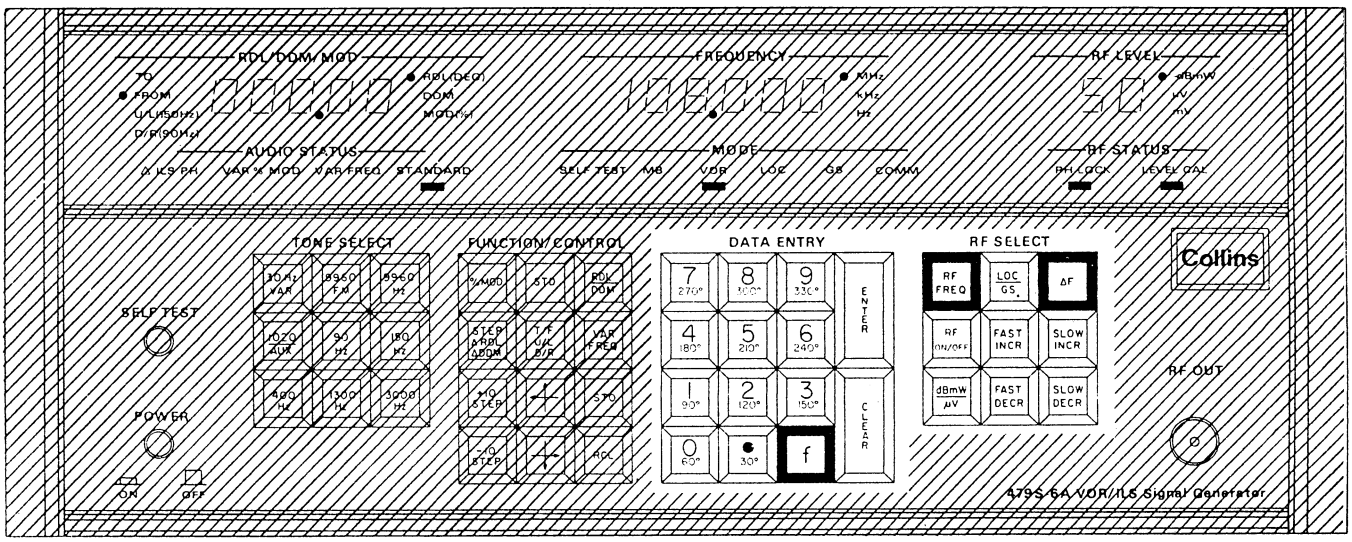
NOTE: SHADED KEYS ARE LIT WHEN ON.

Table 1. TONE SELECT Key Functions.

KEY	FUNCTION
30 Hz VAR	Selects 30-Hz variable VOR signal.
9960 FM	Selects 9960-Hz FM (30-Hz reference) VOR signal.
9960 Hz	Selects 9960-Hz only signal.
1020/AUX	Selects 1020-Hz audio or AUX tone when used in conjunction with VAR FREQ or % MOD-FUNCTION/CONTROL key.
90 Hz	Selects 90-Hz ILS signal.
150 Hz	Selects 150-Hz ILS signal.
400 Hz	Selects 400-Hz (outer marker) marker beacon signal.
1300 Hz	Selects 1300-Hz (middle marker) marker beacon signal.
3000 Hz	Selects 3000-Hz (inner marker) marker beacon signal.

Table 2. FUNCTION/CONTROL Key Functions.

KEY	FUNCTION
% MOD	Enables selection of percent modulation through DATA ENTRY keys and switches RDL/DDM/MOD display to indicate percent modulation.
STD	Switches RDL/DDM/MOD, AUDIO STATUS, FREQUENCY, and RF LEVEL displays back to the preset condition for the selected mode.
RDL/DDM	Enables selection of radial in VOR mode or DDM in ILS mode through DATA ENTRY keys.
STEP ΔRDL ΔDDM	Steps VOR radial in +30-degree steps or ILS DDM in standard DDM steps.
T/F U/L D/R	Selects either a FROM or TO radial in VOR mode or a 90-Hz predominant or 150-Hz predominant signal in ILS mode.
VAR FREQ	Enables DATA ENTRY keys for varying standard tones (30, 9960, 9960 FM, 90, and 150 Hz). Enables selection of AUX audio frequencies through DATA ENTRY keys when used in conjunction with 1020/AUX-TONE SELECT key.
+10 STEP	Steps VOR mode radial in +10-degree steps.
	Slews VOR mode radial in +0.01-degree steps, LOC mode DDM in 0.001 (left) steps, or GS mode DDM in 0.002 (up) steps.
-10 STEP	Steps VOR mode radial in -10-degree steps.
	Slews VOR mode radial in -0.01-degree steps, LOC mode DDM in 0.001 (right) steps, or GS mode DDM in 0.002 (down) steps.
STO	Enables storage of selected setup by entry of memory location in DATA ENTRY keys (operational only on units with options 1 or 2).
RCL	Enables recall of entries in storage by entering memory location in DATA ENTRY keys (operational only on units with options 1 or 2).



NOTE: SHADED KEYS ARE LIT WHEN ON.

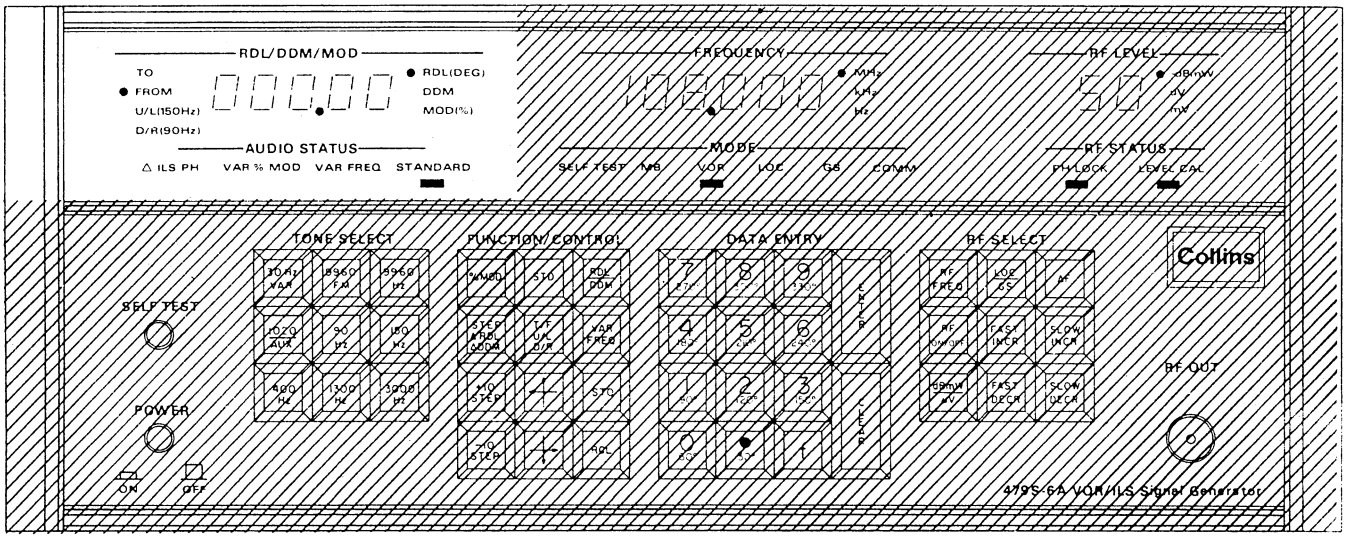
Controls and Indicators
Figure 2 (Sheet 2)

Table 3. DATA ENTRY Key Functions.

KEY	FUNCTION
Numerical 0/60° through 9/330°	Provides numerical entry of rf carrier frequency, VOR radials, ILS DDM, and percent modulation, auxiliary audio frequency, or entry of VOR radials at every 30° major heading when modifier (f) key is enabled (lit). In ILS mode 0/60°, key selects Δ ILS PH when modifier (f) key is enabled (lit).
· (decimal)/30°	Used for numerical entries requiring a decimal point or for a 30-VOR radial when modifier (f) key is enabled (lit).
ENTER	Enables numerical entries to signal generator circuits.
CLEAR	Clears numerical key entry before ENTER key is pressed and also clears nonvalid entries.
f	Selects lower function (°) of DATA ENTRY keys. Used as a modifier when in ILS mode to select Δ ILS PH.

Table 4. RF SELECT Key Functions.

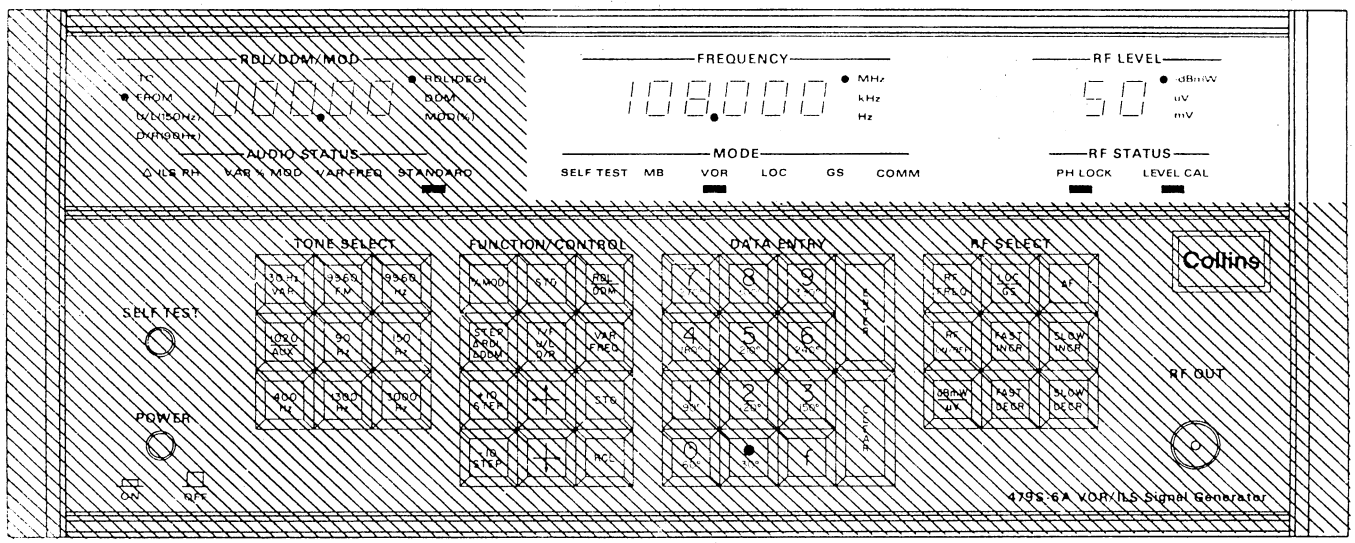
KEY	FUNCTION
RF FREQ	Enables selection of rf carrier frequencies through DATA ENTRY keys. Also used to step rf frequencies.
LOC/GS	Switches rf carrier frequency from selected localizer frequency to paired glideslope frequency or vice versa.
ΔF	Enables rf carrier frequency slewing through FAST INCR, SLOW INCR, FAST DECR, and SLOW DECR keys.
RF ON/OFF	Switches output of RF OUT connector alternately from ON to OFF.
FAST INCR	Increases rf output level in 10-dB steps or, when ΔF key is enabled (lit), increases rf carrier frequency at a fast rate.
SLOW INCR	Increases rf output level in 1-dB steps or, when ΔF key is enabled (lit), increases rf carrier frequency at a slow rate.
FAST DECR	Decreases rf output level in 10-dB steps or, when ΔF key is enabled (lit), decreases rf carrier frequency at a fast rate.
SLOW DECR	Decreases rf output level in 1-dB steps or, when ΔF key is enabled (lit), decreases rf carrier frequency at a slow rate.



Controls and Indicators
Figure 2 (Sheet 3)

Table 5. RDL/DDM/MOD and AUDIO STATUS Display Functions.

DISPLAY/INDICATOR	FUNCTION
RDL/DDM/MOD Display and Indicators	
TO indicator	Indicates generation of a VOR TO radial.
FROM indicator	Indicates generation of a VOR FROM radial.
U/L (150-Hz) indicator	Indicates generation of an ILS up/left (150-Hz predominant) signal
D/R (90-Hz) indicator	Indicates generation of an ILS down/right (90-Hz predominant) signal.
5-digit digital display	Provides numerical indication of generated radial, DDM, or percent modulation.
RDL (DEG) indicator	Indicates digital display is VOR radial in degrees.
DDM indicator	Indicates digital display is ILS DDM.
MOD (%) indicator	Indicates digital display is percent modulation.
AUDIO STATUS Display	
ΔILS PH	Indicates a 60-degree phase shift of the 150-Hz component with respect to the 90-Hz component, as measured between positive-going zero crossing of the 90-Hz and 150-Hz components of the ILS composite waveform.
VAR % MOD indicator	Indicates percent modulation displayed is variable through DATA ENTRY keys.
VAR FREQ	Indicates 30-, 9960-, 9960 FM-, 90-, and 150-Hz tones or AUX audio tone are variable through DATA ENTRY keys.
STANDARD indicator	Indicates standard modulation conditions are present.



Controls and Indicators
Figure 2 (Sheet 4)

Table 6. FREQUENCY and MODE Display Functions.

DISPLAY/INDICATOR	FUNCTION
	FREQUENCY Display
6-digit digital display	Provides numerical indication of actual rf carrier frequency or selected variable audio frequency.
MHz indicator	Indicates rf carrier frequency resolution is 1 kHz.
kHz indicator	Indicates rf carrier frequency resolution is 0.1 kHz.
Hz indicator	Indicates audio frequency with 0.1-Hz resolution to 1 kHz and 1.0-Hz resolution above 1 kHz.
	MODE Display
SELF TEST indicator	Indicates signal generator is in self-test mode.
MB indicator	Indicates marker beacon frequency selected and signal generator is in marker beacon mode.
VOR indicator	Indicates VOR frequency selected and signal generator is in VOR mode.
LOC indicator	Indicates localizer frequency selected and signal generator is in localizer mode.
GS indicator	Indicates glideslope frequency selected and signal generator is in glideslope mode.
COMM indicator	Indicates vhf communication frequency selected and signal generator is in vhf comm mode.

Table 7. RF LEVEL and RF STATUS Display Function.

DISPLAY/INDICATOR	FUNCTION
	RF LEVEL Display
3-digit digital display	Provides numerical indication of rf output level and indicates when rf output is turned off.
-dBmW indicator	Indicates digital readout is displaying rf power in dB mW.
μV indicator	Indicates digital readout is displaying rf output level in microvolts.
mV indicator	Indicates digital readout is displaying rf output level in millivolts.
	RF STATUS Display
PH LOCK indicator	Indicates rf frequency synthesizer is locked onto the selected frequency.
LEVEL CAL indicator	Indicates the rf output from the signal generator is within the specified limits.

3. OPERATION PROCEDURES

Paragraphs 3.1 through 3.15 contain the operating procedures for the signal generator. The procedures provide operating instructions for each mode of operation and each function that can be performed in a mode of operation.

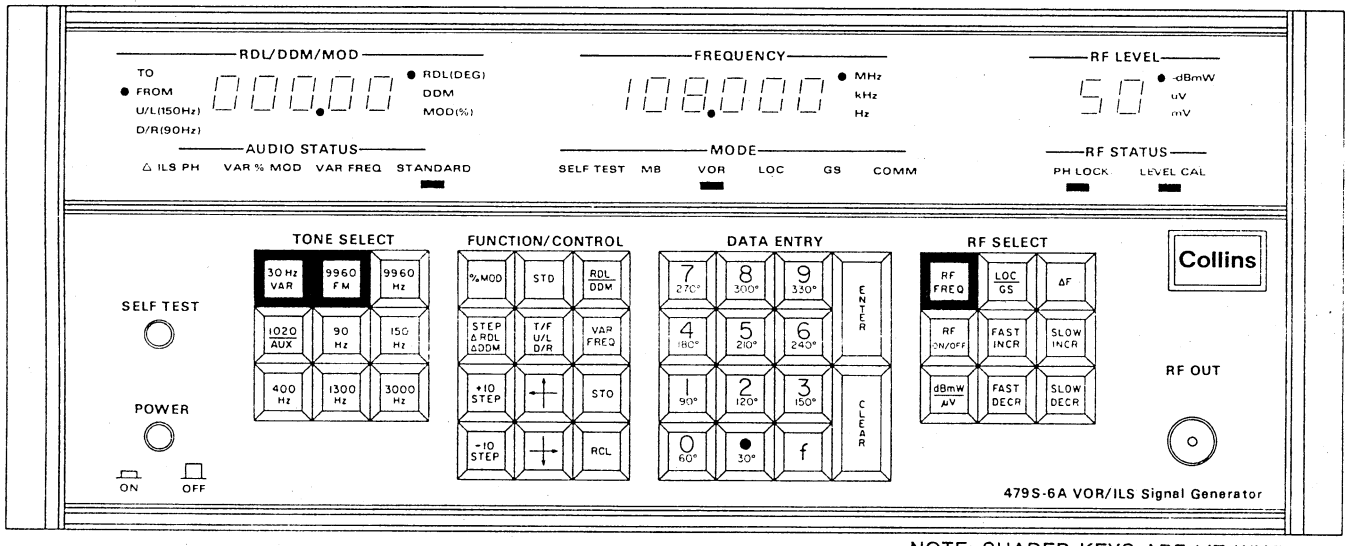
Refer to table 8 for a list of the operating procedures and the applicable paragraph.

Caution

Ensure that signal generator is positioned to provide clearance at rear of generator for intake of cooling air.

Table 8. Operating Procedures Reference List.

OPERATING PROCEDURE	PARAGRAPH
Initial turn-on	3.1
Self-test operation	3.2
Rf output control	3.3
Frequency/mode selection	3.4
Rf frequency slewing	3.5
VOR radial selection and adjustment	3.6
VOR mode tone selection	3.7
ILS DDM selection and adjustment	3.8
Marker beacon marker selection	3.9
Communication mode tone selection	3.10
% modulation adjustment	3.11
External modulation	3.12
Scope trigger	3.13
Store/recall operation	3.14
IEEE operation	3.15



Initial Power On
Figure 3

3.1 Initial Power On (Refer to figure 3.)

a. Press POWER switch to ON.
b. A computer memory check is performed immediately after power is turned on to determine if the output from the memories is correct. If one of the RAM's has an incorrect output, the RF LEVEL display will indicate the RAM that has failed (. . . 1). The signal generator will start another RAM check and will continue to sequence until malfunction is corrected. If an incorrect output occurs on the ROM check, the number of the malfunctioning

ROM is displayed on the RDL/DDM/MOD display and the MODE display SELF TEST indicator is lit momentarily; then the memory chip number and SELF TEST indicator flash on and off. Further functions cannot be performed until the signal generator is repaired.

c. If no malfunctions occur, the indications appear as shown in figure 3. This is the standard VOR mode condition occurring each time ac power is applied.

d. Proceed with tests.

3.2 Self-Test Operation (Refer to figure 4.)

The self-test operation provides the operator with a lamp check and a program check of the signal generator.

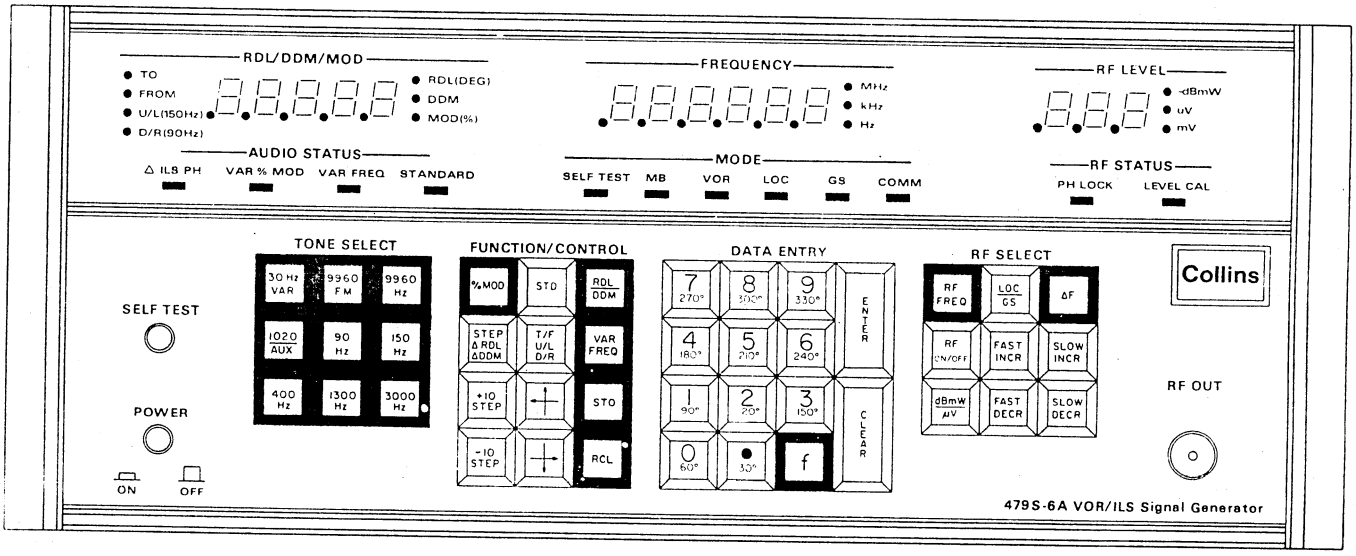
a. Press and hold SELF TEST switch and check indicators, keys, and displays. Refer to figure 4, view A for correct indications.

Note

The STO and RCL keys will light; however, they are nonoperational unless option 1 or 2 is installed in the signal generator.

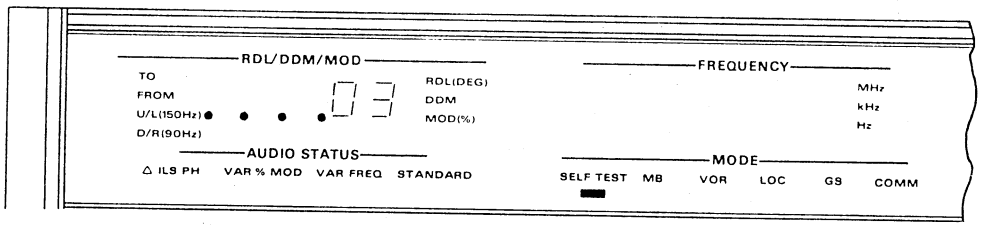
b. Release SELF TEST switch, and program check begins. RDL/DDM/MOD display counts sequentially through programmed memory chips (ROM's). If the output from a memory chip (ROM) is incorrect, the RDL/DDM/MOD display indicates the number of the malfunctioning memory chip, and the MODE display SELF TEST indicator lights. The number of the memory and the SELF TEST indicator flash on and off indicating the malfunction. The signal generator must be repaired before the signal generator can perform any additional functions.

c. After completion of the ROM check, the signal generator switches to the initial power-on status, checks the RAM's, rechecks the ROM's, and then switches to the 108.00-MHz VOR mode preset condition as shown in figure 3.



NOTE: SHADED KEYS ARE LIT WHEN ON.

View A. Lamp Check



View B. Program Check

Self-Test Operation
Figure 4

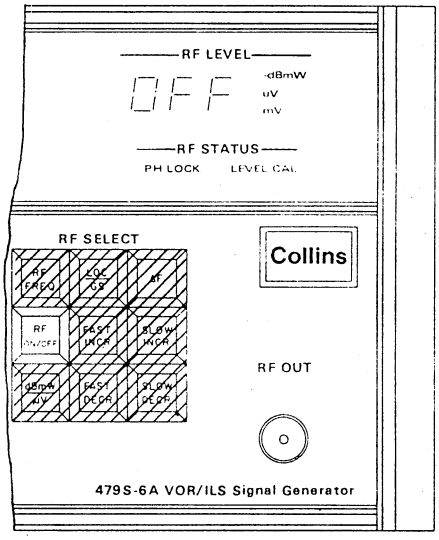
3.3 RF Output Control (Refer to figure 5.)

a. RF Output On/Off (Refer to view A.)

The RF SELECT—RF ON/OFF key provides operator control of the rf output. Press the RF ON/OFF key to turn off or turn on the rf output, depending on the output state, prior to pressing the key. When rf output is removed, the following should be observed:

1. RF LEVEL display indicates OFF.
2. RF STATUS display PH LOCK indicator is off.
3. With modulation tone(s) present, RF STATUS display LEVEL CAL indicator may flicker. With no modulation present, LEVEL CAL indicator is off.

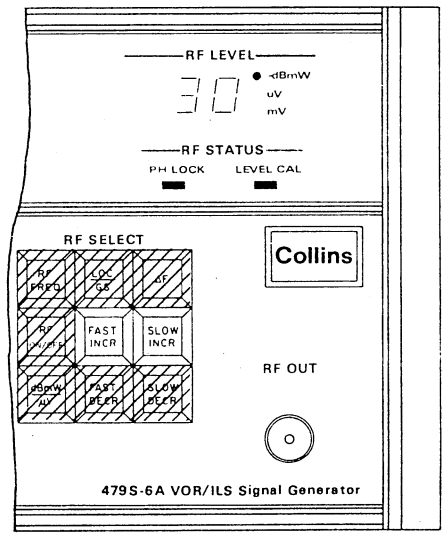
When the rf output is on, the RF LEVEL display indicates the selected output level. The RF STATUS—PH LOCK and LEVEL CAL indicators are lit (on), indicating that the rf synthesizer phase-lock loop is locked and that the output level of the rf modulator circuitry is correct.



View A. RF Output ON/OFF

b. RF Output Level Increase (Refer to view B.)

The rf output level is increased using the RF SELECT—FAST INCR and SLOW INCR keys. The FAST INCR key increases the output level in 10-dB steps, and the SLOW INCR key increases output level in 10-dB steps, and the SLOW INCR key increases the level in 1-dB steps. Keeping either key depressed provides continuous increases in the output level at applicable decibel steps. The RF LEVEL display indicates the level changes.

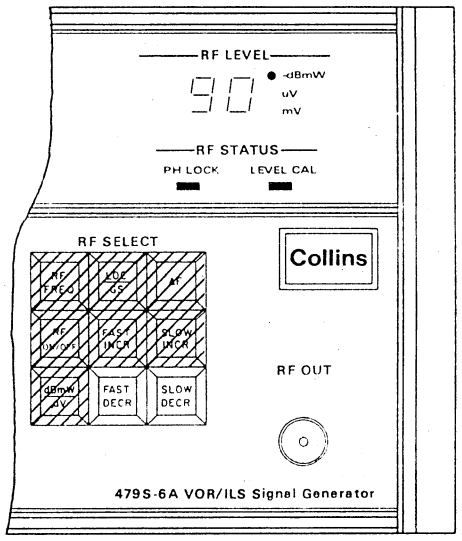


View B. RF Output Increase

RF Output Control
Figure 5 (Sheet 1 of 2)

c. RF Output Level Decrease (Refer to view C.)

The rf output level is decreased using the RF SELECT—FAST DECR and SLOW DECR keys. The operation is the same as described for output level increases in step b except that the output level decreases.



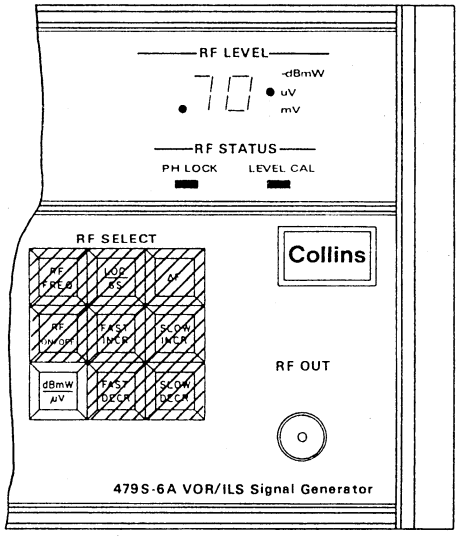
View C. RF Output Decrease

d. RF Output Reference Level Change (Refer to view D.)

The rf output level can be read either in -dB mW or voltage, depending on test requirements. Press RF SELECT—dBmW/μV key to switch RF level display from -dBmW to μV or mV, or vice versa.

Note

When the RF LEVEL is displayed in μV/mV, an additional 6 dB of attenuation is placed in the rf output circuit that provides a "hard microvolt" output at the RF OUT connector. With a "hard microvolt" output, the actual voltage at the RF OUT connector is one-half the voltage indicated on the RF LEVEL display. This eliminates the requirement for an external 6-dB pad.



View D. RF Output Reference Level Change

RF Output Control
Figure 5 (Sheet 2)

3.4 On-Channel/RF Frequency/Mode Selection (Refer to figure 6.)

Refer to table 9 for standard VOR, localizer, glideslope, and marker beacon frequencies. (Additional frequencies in the 74.6- to 75.4-MHz range provide interference signal test capability for the marker beacon mode.) Vhf communication frequencies from 118.000 to 151.975 MHz are selectable at each 25-kHz increment.

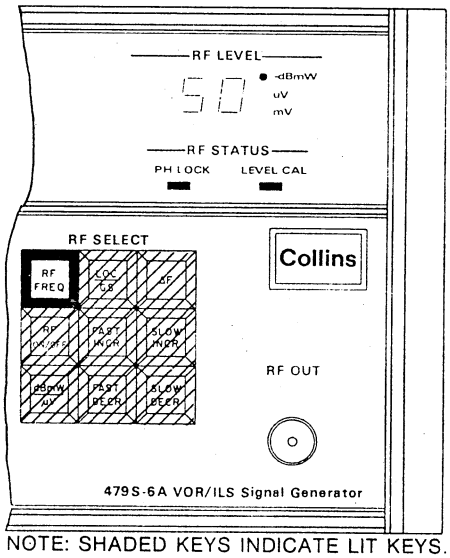
a. Check that RF SELECT—RF FREQ key is lit, indicating that the DATA ENTRY keys are armed to receive rf carrier frequency selections. Refer to view A. If the RF FREQ key is not lit, press key to enable DATA ENTRY keys for frequency selection. RF FREQ key remains lit after entry of the frequency selection for additional frequency selections. The key remains lit until either the FUNCTION/CONTROL—% MOD, RDL/DDM, or VAR FREQ, or the DATA ENTRY—f key is pressed.

b. Enter selected rf carrier frequency on DATA ENTRY numerical keys. Refer to view B. If an error is made during entry of the frequency and before the ENTER key is pressed, press CLEAR key to remove entered frequency, and reenter correct frequency.

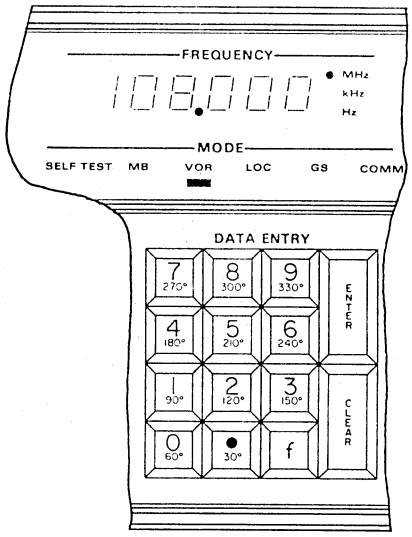
c. Press DATA ENTRY—ENTER key to enter selected frequency in signal generator circuits.

d. FREQUENCY display indicates the selected rf carrier frequency and the MODE display indicates the mode of operation for the selected frequency automatically. If display is blinking, the data entered is invalid. Press DATA ENTRY—CLEAR key to clear display, and repeat steps b through d.

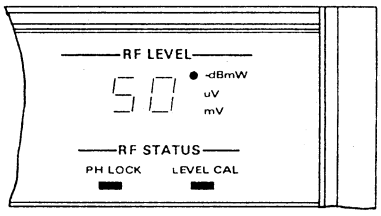
e. RF STATUS—PH LOCK AND LEVEL CAL indicators are lit, indicating signal generator is locked on the selected frequency and the rf output is calibrated. Refer to view C. If either indicator is not lit, repair signal generator.



View A. RF Frequency Selection Enable



View B. RF Frequency Entry and Display With Mode Indicator



View C. RF Status Indicators

Frequency/Mode Selection
Figure 6 (Sheet 1 of 2)

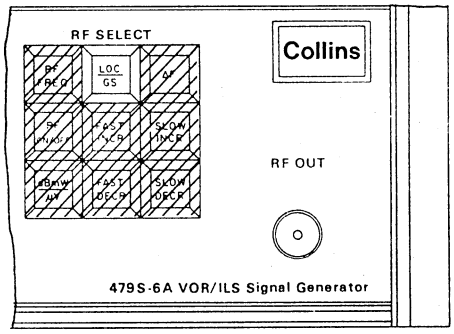
f. When the RF SELECT—RF key is lit and the carrier is being modulated, each successive depression of the RF FREQ key will step the carrier up one channel in the mode selected. The signal generator will step to the highest frequency and then return to the lowest frequency for the selected mode on the next step in all modes except LOC. When the highest channel is reached in LOC mode, the next step will place the signal generator in VOR mode (112.00 MHz).

g. When the RF SELECT—RF FREQ key is lit and the carrier is not modulated (all TONE SELECT keys off), each successive depression of the RF FREQ key will step the carrier up in 50-kHz steps in VOR/LOC, 150-kHz steps in GS, and 25-kHz steps in COMM.

h. Selection of a new mode automatically initializes standard modulation at the proper level. Refer to figure 7 for preset conditions. Rf power level, however, remains at the last level set (except following a self-test). If any, or all, tones are deleted, changing rf frequencies within a mode will leave the tone status unchanged.

i. Selection of an rf carrier frequency automatically selects the corresponding 2-of-5 code outputs. These lines are available at the REMOTE TUNE connector for channeling the receiver under test. When performing off-channel tests, such as if selectivity measurements, the REMOTE TUNE channeling information remains tuned to the last rf channel selected prior to entering the variable rf mode. The REMOTE TUNE connector also provides NAV disable, COMM disable, and LOC/GS energize mode discretes, as well as two logic signals for control of antenna relay switching.

j. In the ILS modes, if a localizer rf carrier frequency is selected and it is desired to change to a paired glideslope rf carrier frequency or vice versa, press RF SELECT—LOC/GS key and the signal generator will switch to the paired frequency and mode in a preset condition. Refer to view D.

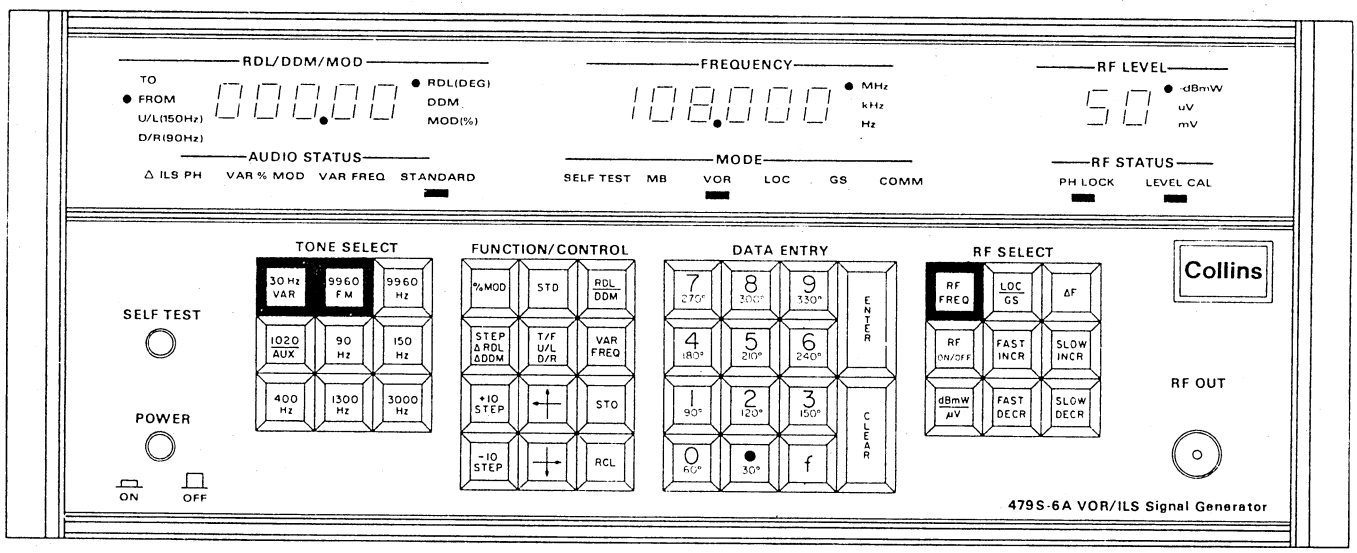


View D. ILS Mode Change

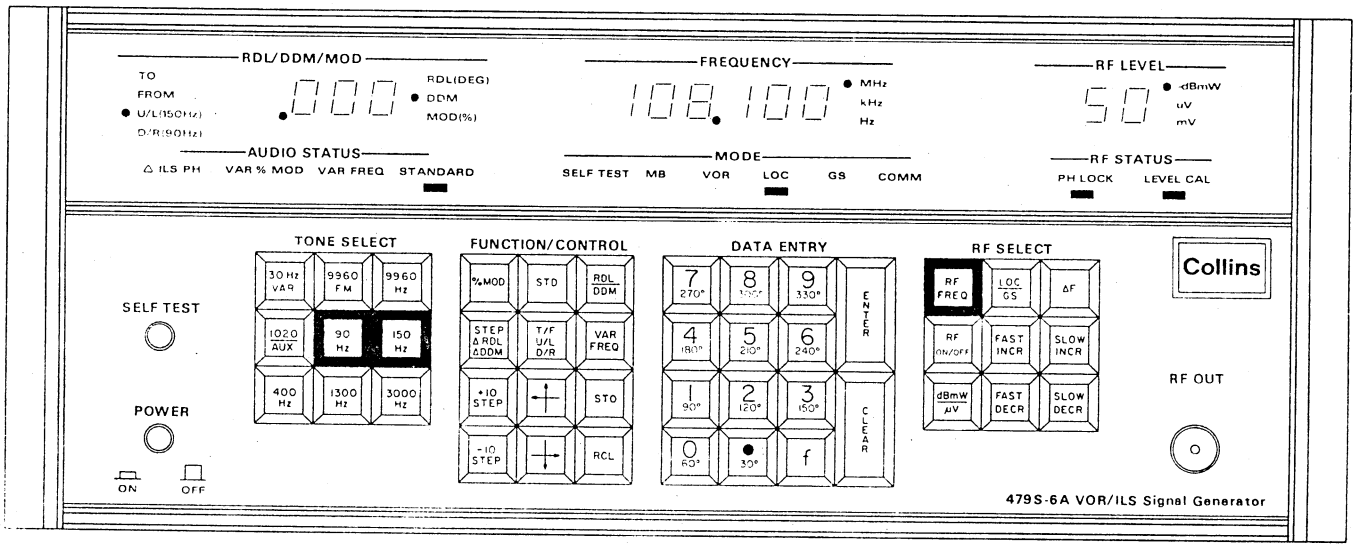
Frequency/Mode Selection
Figure 6 (Sheet 2)

Table 9. Standard VOR, ILS (Localizer and Glideslope), and Marker Beacon Frequencies.

VOR FREQUENCIES (MHz)			PAIRED ILS FREQUENCIES		MARKER BEACON FREQUENCIES (MHz)
			LOCALIZER (MHz)	GLIDESLOPE (MHz)	
108.00	112.70	115.40	108.10	334.70	74.600
108.05	112.75	115.45	108.15	334.55	74.625
108.20	112.80	115.50	108.30	334.10	74.650
108.25	112.85	115.55	108.35	333.95	74.675
108.40	112.90	115.60	108.50	329.90	74.700
108.45	112.95	115.65	108.55	329.75	74.725
108.60	113.00	115.70	108.70	330.50	74.750
108.65	113.05	115.75	108.75	330.35	74.775
108.80	113.10	115.80	108.90	329.30	74.800
108.85	113.15	115.85	108.95	329.15	74.825
109.00	113.20	115.90	109.10	331.40	74.850
109.05	113.25	115.95	109.15	331.25	74.875
109.20	113.30	116.00	109.30	332.00	74.900
109.25	113.35	116.05	109.35	331.85	74.925
109.40	113.40	116.10	109.50	332.60	74.950
109.45	113.45	116.15	109.55	332.45	74.975
109.60	113.50	116.20	109.70	333.20	75.000
109.65	113.55	116.25	109.75	333.05	75.025
109.80	113.60	116.30	109.90	333.80	75.050
109.85	113.65	116.35	109.95	333.65	75.075
110.00	113.70	116.40	110.10	334.40	75.100
110.05	113.75	116.45	110.15	334.25	75.125
110.20	113.80	116.50	110.30	335.00	75.150
110.25	113.85	116.55	110.35	334.85	75.175
110.40	113.90	116.60	110.50	329.60	75.200
110.45	113.95	116.65	110.55	329.45	75.225
110.60	114.00	116.70	110.70	330.20	75.250
110.65	114.05	116.75	110.75	330.05	75.275
110.80	114.10	116.80	110.90	330.80	75.300
110.85	114.15	116.85	110.95	330.65	75.325
111.00	114.20	116.90	111.10	331.70	75.350
111.05	114.25	116.95	111.15	331.55	75.375
111.20	114.30	117.00	111.30	332.30	75.400
111.25	114.35	117.05	111.35	332.15	
111.40	114.40	117.10	111.50	332.90	
111.45	114.45	117.15	111.55	332.75	
111.60	114.50	117.20	111.70	333.50	
111.65	114.55	117.25	111.75	333.35	
111.80	114.60	117.30	111.90	331.10	
111.85	114.65	117.35	111.95	330.95	
112.00	114.70	117.40			
112.05	114.75	117.45			
112.10	114.80	117.50			
112.15	114.85	117.55			
112.20	114.90	117.60			
112.25	114.95	117.65			
112.30	115.00	117.70			
112.35	115.05	117.75			
112.40	115.10	117.80			
112.45	115.15	117.85			
112.50	115.20	117.90			
112.55	115.25	117.95			
112.60	115.30				
112.65	115.35				

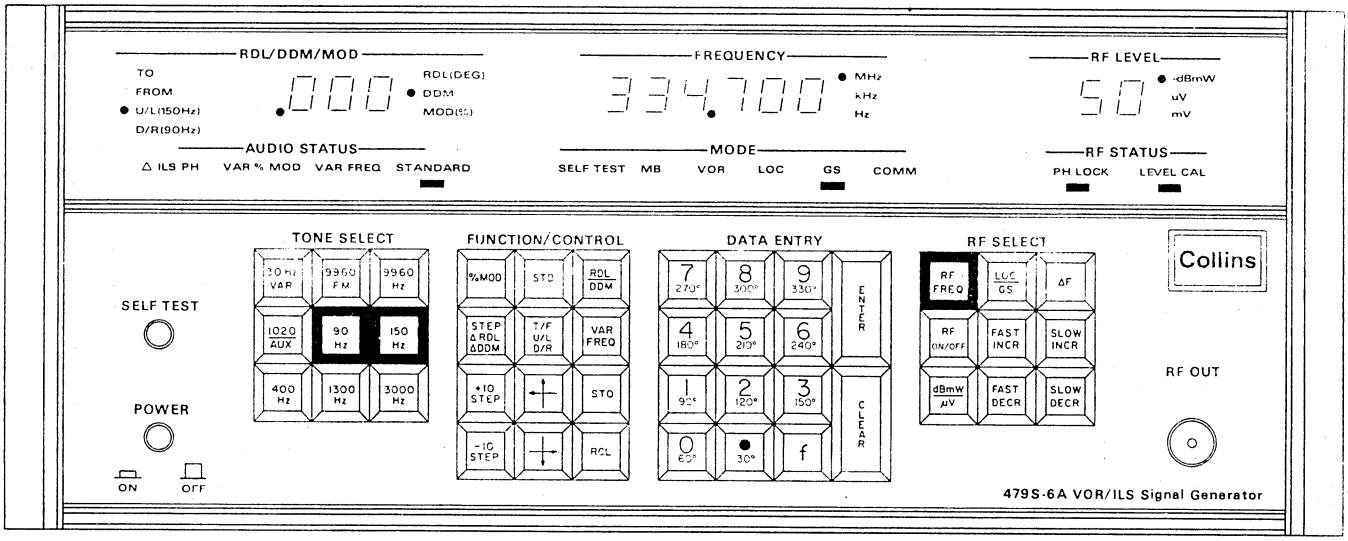


View A. VOR Mode Preset Condition

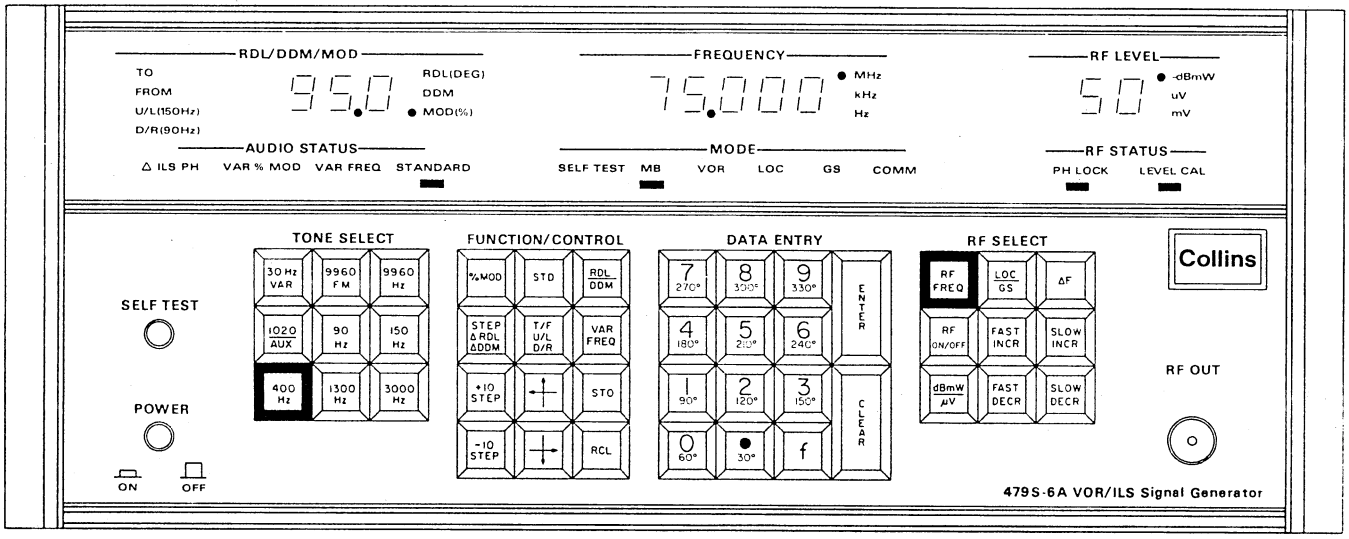


View B. LOC Mode Preset Condition

Preset Conditions
Figure 7 (Sheet 1 of 3)

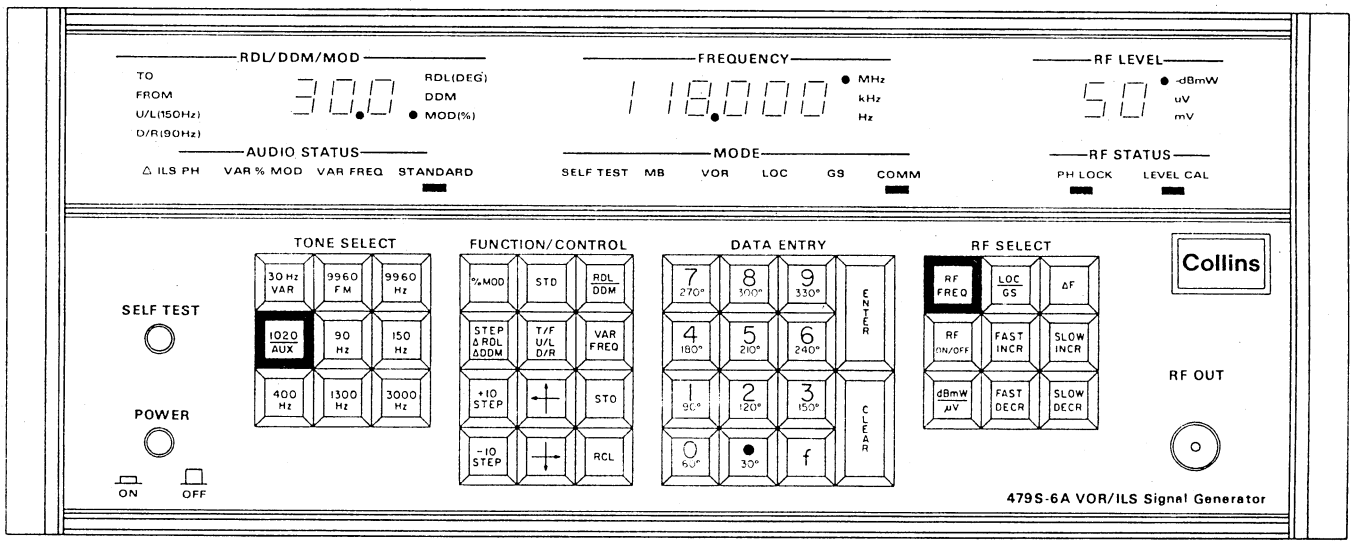


View C. GS Mode Preset Condition



View D. Marker Beacon Mode Preset Condition

Preset Conditions
Figure 7 (Sheet 2)



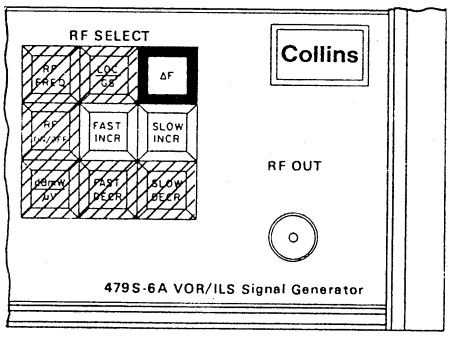
View E. VHF COMM Mode Preset Condition

Preset Conditions
Figure 7 (Sheet 3)

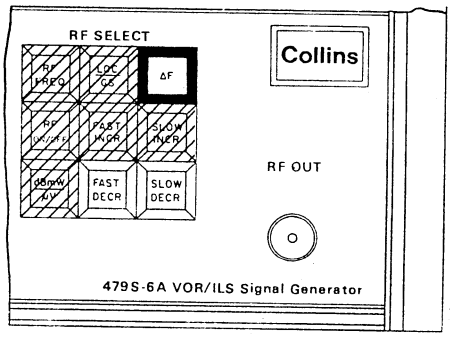
3.5 Off-Channel RF Frequency Selection (Refer to figure 8.)

The frequency can be varied in both directions from the selected rf carrier frequency. The frequency can be increased or decreased to ±1-channel spacing of the selected frequency to check receiver selectivity.

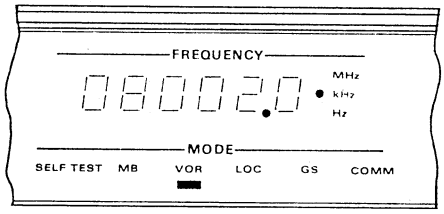
a. Press RF SELECT—ΔF key: key lights indicating FAST INCR, SLOW INCR, FAST DECR, and SLOW DECR, and DATA ENTRY keys are enabled to vary rf carrier frequency. Refer to views A and B. When ΔF mode is enabled, the mode selects at the REMOTE TUNE connector remain at the last selected channel frequency. FREQUENCY display changes to kHz indications, dropping the most significant numeral of the VOR, localizer, glideslope, or vhf communication frequency. Refer to view C.
b. To increase rf frequency at a fast rate, press FAST INCR key; to increase frequency at a slow rate, press SLOW INCR key. To decrease frequency, use FAST DECR and SLOW DECR keys. Refer to views A and B.
c. FREQUENCY display indicates frequency increases and decreases.
d. To vary the frequency from the DATA ENTRY keyboard:
   1. Enter selected rf frequency on DATA ENTRY numerical keys (1-kHz steps). The decimal must be entered explicitly. For example, if the selected frequency is 108.002, enter 108.002 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press DATA ENTRY CLEAR key to remove the incorrect entry and reenter the correct frequency.
   2. Press DATA ENTRY—ENTER key to enter selected frequency in signal generator circuits.
e. Press ΔF key again to return rf carrier frequency to the last selected channel frequency.



View A. Frequency Increase



View B. Frequency Decrease



View C. Frequency Display

NOTE: SHADED KEYS INDICATE LIT KEYS.

RF Frequency Slewing
Figure 8

3.6 VOR Radial Selection and Adjustment (Refer to figure 9.)

a. Radial Selection

The VOR radial can be selected from 000.00 to 359.99 in 0.01-degree increments or on major headings at every 30 degrees.

1. Incremental Selection

   (a) Check that FUNCTION/CONTROL—RDL/DDM key is lit. Refer to view A. If key is not lit, press RDL/DDM key to enable entry of selected radial through DATA ENTRY keys. RDL/DDM key lights and remains lit after the radial selection so that additional radial selections can be made. Key remains lit until either the RF SELECT—RF FREQ, the FUNCTION/CONTROL—% MOD or VAR freq, or the DATA ENTRY—f key is pressed.

   (b) Enter selected VOR radial on DATA ENTRY numerical keys. Refer to view B. The decimal point must be entered explicitly. For example, if the selected radial is 301.10 degrees, enter 301.1 on the DATA ENTRY keys. If an error is made during the entry of the selected radial and before the ENTER key is pressed, press DATA ENTRY—CLEAR key to remove the incorrect entry and reenter the correct radial.

   (c) Press DATA ENTRY—ENTER key to enter selected radial data in signal generator circuits.

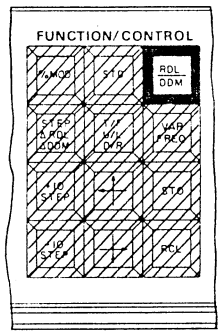
   (d) RDL/DDM/MOD display indicates the selected VOR radial in degrees and provides a FROM indication. Refer to view C. If display is blinking, the data entered is unacceptable. Press DATA ENTRY—CLEAR key to clear display and repeat steps a through c.

2. Major Heading Selection

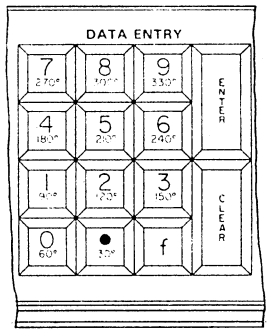
   (a) Press the DATA ENTRY—f key to enable entry of desired radial degree marked on DATA ENTRY keys. Refer to view D. The key lights when enabled. Key remains lit until the RF SELECT—RF FREQ or the FUNCTION CONTROL—% MOD, VAR FREQ, or RDL/DDM key is pressed.

   (b) Press DATA ENTRY key for selected VOR radial.

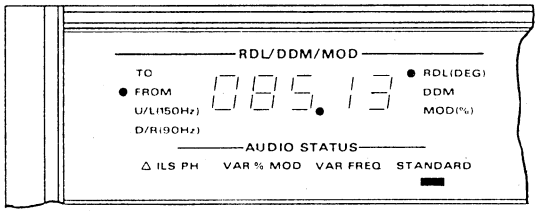
   (c) RDL/DDM/MOD display indicates the selected radial in degrees and provides a FROM indication.



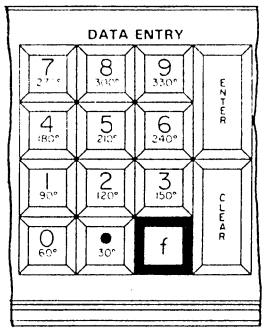
View A. Radial Selection Enable



View B. Radial Selection Entry



View C. Radial Display



View D. Major Heading Radial Selection Entry

VOR Radial Selection and Adjustment
Figure 9 (Sheet 1 of 2)

b. Radial Adjustment

The radial is adjustable from the selected radial in +30-, +10-, -10-, +0.01-, and -0.01-degree steps. Refer to view E.

1. +30-Degree Adjustment

Press FUNCTION/CONTROL—STEP/ΔRDL/ΔDDM key once for each 30-degree-step increase required. Holding key depressed does not provide continuous 30-degree-step increases.

2. +10-Degree Adjustment

Press FUNCTION/CONTROL— +10 STEP key once for each 10-degree-step increase required. Holding key depressed does not provide continuous 10-degree-step increases.

3. -10-Degree Adjustment

Press FUNCTION/CONTROL— -10 STEP key once for each 10-degree-step decrease required. Holding key depressed does not provide continuous 10-degree-step decreases.

4. +0.01-Degree Adjustment

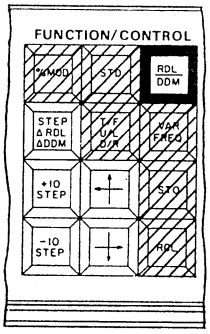
Press FUNCTION/CONTROL— ◄╋ Key once for each 0.01-degree-step increase required. Holding key depressed provides continuous 0.01-degree-step increases.

5. -0.01-Degree Adjustment

Press FUNCTION/CONTROL— ╋► Key once for each 0.01-degree-step decrease required. Holding key depressed provides continuous 0.01-degree-step decreases.

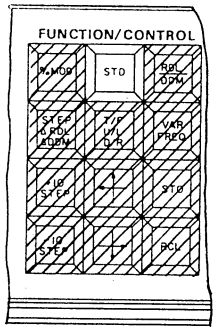
d. TO-FROM Signal Switching (Refer to view G.)

Press FUNCTION/CONTROL—T/F U/L D/R key to change from a TO radial to a FROM radial, or vice versa. RDL/DDM/MOD display TO/FROM indicator changes; however, bearing display remains at the last selected bearing. Refer to view H.

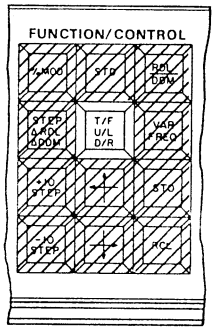


NOTE: SHADED KEYS INDICATE LIT KEYS.

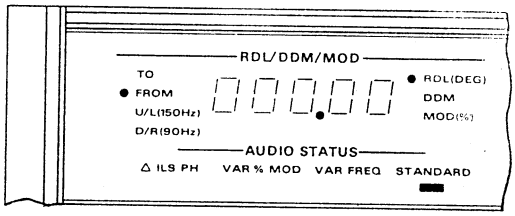
View E. Radial Adjustment



View F. Reset-to-Preset Condition



View G. TO-FROM Signal Switching



View H. TO-FROM Signal Indicator

VOR Radial Selection and Adjustment
Figure 9 (Sheet 2)

3.7 VOR Mode Tone Selections (Refer to figure 10.)

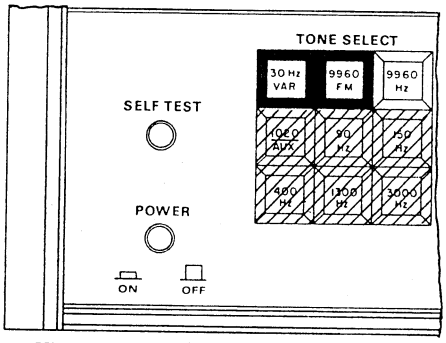
a. In the preset condition, 30-Hz variable and 9960-Hz FM (30-Hz reference) are selected and the TONE SELECT—30 Hz VAR and 9960 FM keys are lit. Either signal or both signals can be removed for flag checks or other test requirements by pressing the applicable key. The key light is turned off when the signal is removed. Press key again to add the removed signal. Refer to view A.

b. To obtain a 9960-Hz-only signal (30-Hz reference removed) for flag or other receiver checks, press TONE SELECT—9960 Hz key. 9960 Hz key lights and 9960 FM key light goes out. Press 9960 FM key to return to 9960 FM signal containing 30-Hz reference.

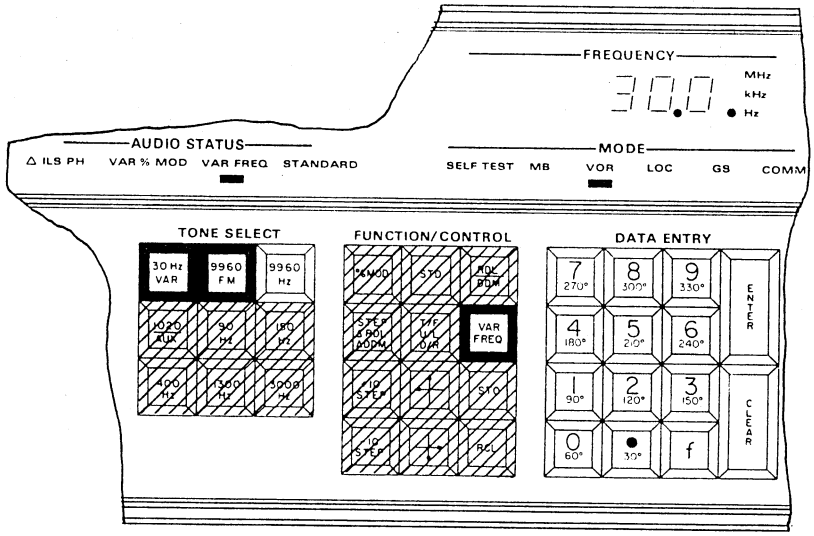
c. 30-Hz/9960-Hz Adjustments (Refer to view B.)

The 30-Hz and 9960-Hz TONES are adjustable ±5 percent. The 9960-Hz tone frequency varies automatically when a change is made to the 30-Hz VAR tone frequency.

1. Press the FUNCTION CONTROL—VAR FREQ key. The key will light and the VAR FREQ indicator will light. Press STD key to turn off.
2. Press the TONE SELECT—30-Hz VAR key. The 30-Hz frequency will be displayed.
3. Enter new selected frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 31.50 is to be entered, enter 31.5 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency. Press DATA ENTRY—ENTER key to enter selected frequency in signal generator circuits.
4. New frequency will be displayed. To observe frequency of the 9960-Hz tone, press TONE SELECT—9960 FM or 9960 Hz keys.



View A. 30-Hz/9960-Hz Tone Selection



NOTE: SHADED KEYS INDICATE LIT KEYS.

View B. 30-Hz/9960-Hz Adjustment

VOR Mode Tone Selection
Figure 10 (Sheet 1 of 2)

d. Audio Tone Addition

A preset 1020-Hz or an auxiliary 30-Hz to 14-kHz audio tone may be added to the VOR signal. For special test purposes, 10- to 30-Hz audio tones may also be added. Refer to view C.

1. Preset 1020-Hz Audio Tone

Press TONE SELECT—1020/AUX key. Key lights and a 1020-Hz audio tone is added to the VOR signal if VAR FREQ key is not lit. Press key again to remove signal. If VAR FREQ key is pressed while the 1020 Hz is on, the 1020-Hz will then go off.

2. AUX (10-Hz to 14-kHz) AUDIO TONE

(a) Press FUNCTION/CONTROL—VAR FREQ key. Key lights and VAR FREQ indicator lights. Press STD key to turn off.

(b) Press TONE SELECT—1020/AUX key. Key lights and a 1000-Hz audio tone is added to the VOR signal and displayed on the FREQUENCY indicator. To turn off AUX audio tone, depress FUNCTION/CONTROL—VAR FREQ key followed by TONE SELECT—1020/AUX key.

(c) Frequency Adjustments

The frequency can be adjusted from 30 Hz to 14 kHz. Entries that would exceed the range cause the FREQUENCY indicator to flash and the AUX frequency to remain at last valid entry. Pressing any front panel key causes flashing to cease.

Note

Entries from 10 to 30 Hz are also allowed for special test purposes and will not cause the FREQUENCY indicator to flash.

(1) Frequency Selection

Enter selected audio frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. Frequencies can be entered in 0.1-Hz increments below 1 kHz and 1-Hz increments above 1 kHz. For example, if 25.5 Hz is desired, enter 25.5 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency. Press DATA ENTRY—ENTER key to enter selected audio frequency in signal generator circuits.

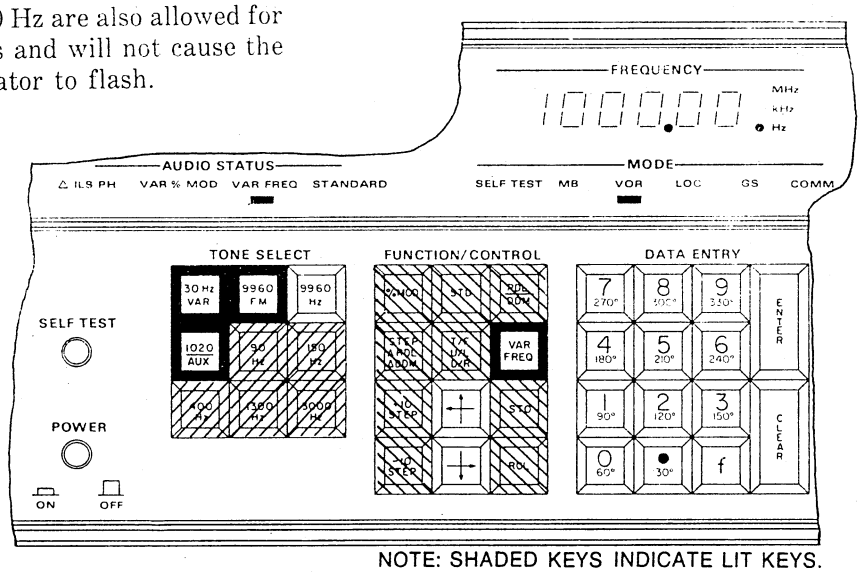
(2) AUX Audio Frequency Slewing

Press FUNCTION/CONTROL— ⊣+ key once for each step increase desired. Holding key depressed provides continuous frequency increase. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz.

Press FUNCTION/CONTROL— +⊢ key once for each step decrease desired. Holding key depressed provides continuous frequency decrease. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz.

Note

Adjusting AUX audio above 3000 Hz deletes standard VOR tones, if present.



View C. Audio Tone Selection

VOR Mode Tone Selection
Figure 10 (Sheet 2)

3.8 ILS DDM Selection and Adjustment (Refer to figure 11.)

In the localizer and glideslope modes, the DDM is preset to 0.000 or the beam center. The DDM is selectable in 0.001-steps within a specific range for each mode, adjustable in standard steps, and can be slewed continuously in either direction. Table 10 is a list of the standard DDM steps, the DDM selection range, and the slewing increments for each mode of operation.

In the ILS modes, the RDL/DDM/MOD—U/L (150-Hz) and D/R (90-Hz) indicators will indicate which of the ILS signals is predominant (has the larger amplitude.) For example, when the U/L (150-Hz) indicator is lit, the 150-Hz signal is predominant.

Table 10. DDM Increments, Steps, and Ranges.

MODE	PRESET CONDITION	STD DDM STEPS	SELECTION RANGE	SLEWING INCREMENTS
Localizer	0.000	0.000, ±0.046, ±0.093, ±0.155, ±0.200	0.000 to ±0.400	0.001
Glideslope	0.000	0.000, ±0.045, ±0.091, ±0.175, ±0.400	0.000 to ±0.800	0.002

Different but equivalent terminology is used between generations of test equipment used for testing ILS Receivers. Table 11 provides the necessary information for conversion between DDM factors commonly used and ratio of audio tones expressed in dB. Additionally, equivalent percent amplitude modulation levels and nominal receiver microamp levels are provided.

Table 11. ILS Tone Ratio/DDM Conversion Chart.

Note

The following information explains how table 11 values were obtained:

(1) Conversion of any tone ratio (expressed in dB) to the equivalent difference in depth of modulation (DDM) is accomplished as follows:

(a) Convert dB to ratio

$$R = 10^{x}, \text{ where } x = \frac{dB}{20}$$

(b) Calculate

$$DDM = M \times \frac{R - 1}{R + 1}$$

where M = modulation peak expressed as a decimal.

(c) $$DDM_{(LOC)} = 0.4 \times \frac{R - 1}{R + 1}$$

(d) $$DDM_{(GS)} = 0.8 \times \frac{R - 1}{R + 1}$$

Table 11. ILS Tone Ratio/DDM Conversion Chart (Cont).

(2) Calculating theoretical receiver output deflection given a DDM is accomplished as follows:

(a) $\mu A_{(LOC)}$ = DDM x 967.7

(b) $\mu A_{(GS)}$ = DDM x 857.1

(3) Computing modulation percentages given a DDM is accomplished as follows:

(a) % mod larger (LOC) = 20 + 50 x DDM

% mod smaller (LOC) = 20 - 50 x DDM

(b) % mod larger (GS) = 40 + 50 x DDM

% mod smaller (GS) = 40 - 50 x DDM

(c) Additionally, a simple thought process procedure can be used to determine mod % given a DDM.

1. Move the decimal two places to the right.
2. Divide by 2.
3. Add to 20 (LOC) or 40 (GS). This result is the mod % of the larger tone.
4. Subtract the mod % of the larger tone from 40 (LOC) or 80 (GS) to get the mod % of the smaller tone.

TONE	LOCALIZER (LOC)			GLIDESLOPE (GS)		
RATIO (dB)	*DDM	$\left(\frac{\% \text{ MOD}}{\frac{\text{LARGER}}{\text{SMALLER}}}\right)$	RCVR DEFLECTION (μA)	*DDM	$\left(\frac{\% \text{ MOD}}{\frac{\text{LARGER}}{\text{SMALLER}}}\right)$	RCVR DEFLECTION (μA)
0.0	0.000	$\frac{20.00}{20.00}$	0	0.000	$\frac{40.00}{40.00}$	0
0.5	0.012	$\frac{20.58}{19.42}$	12	0.023	$\frac{41.15}{38.85}$	20
0.98	0.023	$\frac{21.13}{18.87}$	22	0.045	$\frac{42.25}{37.75}$	39
1.98	0.0456	$\frac{22.28}{17.72}$	44	0.091	$\frac{44.55}{35.45}$	78
2.00	0.0458	$\frac{22.29}{17.71}$	44	0.092	$\frac{44.59}{35.41}$	79
2.01	0.046	$\frac{22.30}{17.70}$	45	0.092	$\frac{44.60}{35.40}$	79
3.86	0.087	$\frac{24.37}{15.63}$	84	0.175	$\frac{48.75}{31.25}$	150
4.00	0.091	$\frac{24.53}{15.47}$	88	0.181	$\frac{49.05}{30.95}$	155
4.11	0.093	$\frac{24.65}{15.35}$	90	0.186	$\frac{49.30}{30.70}$	159
7.10	0.155	$\frac{27.75}{12.25}$	150	0.310	$\frac{55.50}{24.50}$	266

Table 11. ILS Tone Ratio/DDM Conversion Chart (Cont).

TONE	LOCALIZER (LOC)			GLIDESLOPE (GS)		
RATIO (dB)	*DDM	(% MOD LARGER / SMALLER)	RCVR DEFLECTION (μA)	*DDM	(% MOD LARGER / SMALLER)	RCVR DEFLECTION (μA)
7.50	0.163	28.14 / 11.86	158	0.325	56.27 / 23.73	279
9.54	0.200	30.00 / 10.00	194	0.400	60.00 / 20.00	343
∞	0.400	40.00 / 00.00	387	0.800	80.00 / 00.00	686

*DDM (Difference in Depth of Modulation) - the larger percent (%) of modulation less the smaller percent (%) of modulation divided by 100.

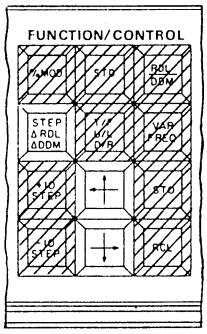
NOTE: 150-Hz tone predominant: localizer is left, glideslope is up;
90-Hz tone predominant: localizer is right, glideslope is down.

a. Standard DDM Adjustments

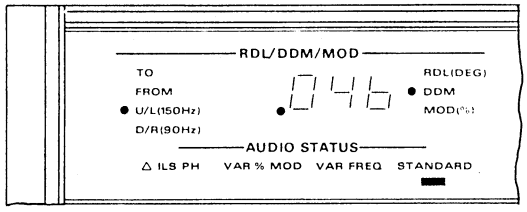
1. Press FUNCTION/CONTROL— STEP ΔRDL ΔDDM key for each standard DDM step required. Refer to view A. The DDM cycles through each standard DDM step and back to 0.000. Each change of DDM step requires pressing the STEP ΔRDL ΔDDM key. When activated, the FUNCTION/CONTROL—STEP ΔRDL ΔDDM key steps the DDM in the U/L (150-Hz) direction unless the D/R (90-Hz) indicator is lit. If the D/R (90-Hz) indicator is lit, the DDM steps in the D/R (90-Hz) direction until maximum deviation is reached and the next step returns the DDM to 0.000 or beam center. At beam center, the DDM returns to a U/L (150-Hz) signal and indication and remains in the U/L (150-Hz) condition until D/R (90 Hz) is again selected.
2. RDL/DDM/MOD display indicates DDM step and U/L (150-Hz) indicator is lit. Refer to view B.

b. DDM Slewing

Press and hold FUNCTION/CONTROL ←╋ key to slew the DDM up/left or the ╋→ key to slew the DDM down/right. Refer to view A. In the localizer mode, the DDM varies in 0.001 steps; in the glideslope mode, the DDM varies in 0.002 steps.



View A. Standard DDM Step and Slewing Keys



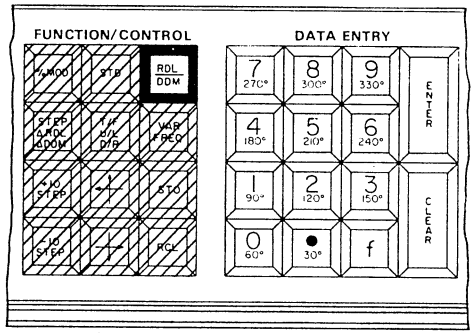
View B. DDM Display

ILS DDM Selection and Adjustment
Figure 11 (Sheet 1 of 5)

c. DDM Selection

The DDM is selectable in 0.001 increments. In the localizer mode, the DDM is selectable from 0.000 to ±0.400; in the glideslope mode, the DDM is selectable from 0.000 to ±0.800.

1. Press FUNCTION/CONTROL—RDL/DDM key to enable entry of DDM selection through DATA ENTRY keys. Refer to view C. The key lights when DDM entry is enabled and remains lit for additional entries until either the % MOD, VAR FREQ, RF SELECT—RF FREQ, or DATA ENTRY—f key is pressed.
2. Enter selected DDM on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 0.040 is to be entered, enter .04 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct DDM.
3. Press DATA ENTRY—ENTER key to enter selected DDM in signal generator circuits.
4. RDL/DDM/MOD display indicates selected DDM. If display is blinking, the data entered is unacceptable. Press DATA ENTRY—clear key to clear display and repeat steps 2 through 4.

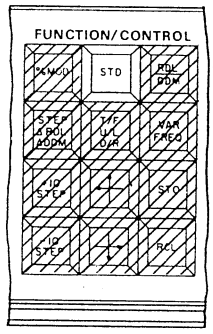


NOTE: SHADED KEYS INDICATE LIT KEYS.

View C. DDM Selection

d. Return to Preset Condition

Press FUNCTION/CONTROL—STD key and signal generator returns RDL/DDM/MOD display information to preset condition for selected mode. Refer to view D.

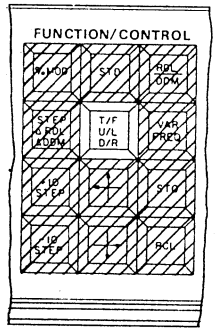


View D. Return-to-Preset Condtion

e. DDM Balance Check Adjustments

On beam center (0.000 DDM), neither the U/L (150-Hz) or D/R (90-Hz) tone is predominant. However, the RDL/DDM/MOD display U/L (150-Hz) indicator is lit to indicate the direction the DDM will go when the DDM is changed via step, slew, or keyboard selection. The DDM is changed in direction by the FUNCTION/CONTROL—T/F U/L D/R key. Refer to view E. A DDM of at least 0.001 must be selected before the ILS signal can be switched to D/R (90 Hz). The signal remains D/R (90 Hz) while being stepped until maximum deviation is reached. The next step returns the DDM to beam center (0.000 DDM). When the beam center is reached, the ILS signal switches back to U/L (150 Hz). Perform balance check as follows:

1. Set signal generator to required DDM by stepping DDM, slewing DDM, or selecting DDM through DATA ENTRY keys.



View E. DDM Balance Adjustment

ILS DDM Selection and Adjustment
Figure 11 (Sheet 2)

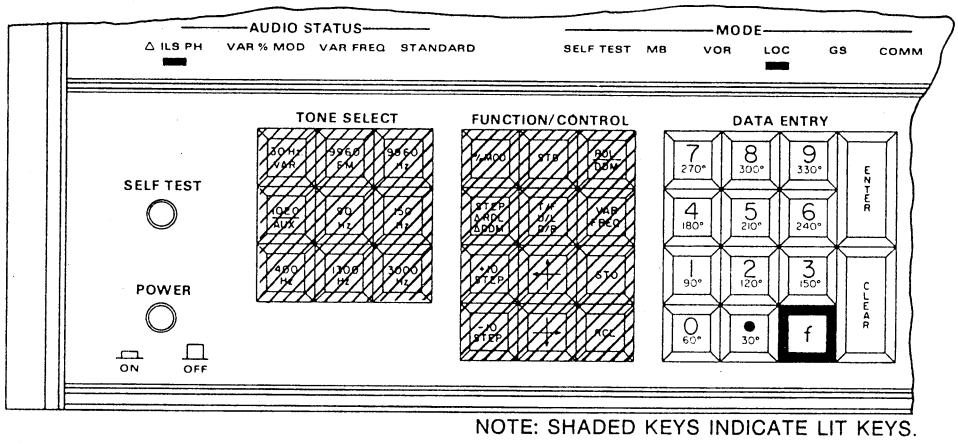
2. Press FUNCTION/CONTROL—T/F U/L D/R key to switch DDM to D/R (90 Hz).
3. Change DDM to next required DDM either by stepping, slewing, or keyboard selection.
4. Press FUNCTION/CONTROL—T/F U/L D/R key to switch DDM to U/L (150 Hz).

Note

The above procedures are typical for discussion of signal generator operation and can be varied as required during actual receiver testing.

f. ILS Phase Adjustment (Refer to view F.)

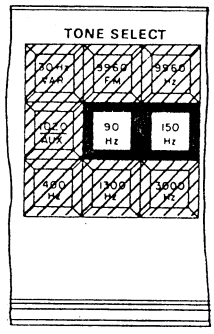
1. The phase between the 90- and 150-Hz signals can be varied in either localizer or glideslope modes. Press DATA ENTRY—f key to enable phase shift. Key will light.
2. Depress DATA ENTRY $\frac{0}{60°}$ key to produce an ILS composite signal with a 60-degree phase shift between the 90- and 150-Hz signals. (Phase shift equals 60 degrees of the 150-Hz component, measured between positive-going zero crossings.) The AUDIO STATUS—ILS PH indicator lights when the phase shift is entered.
   (a) DDM's may be entered from the keyboard. When entered from keyboard, press FUNCTION CONTROL—$\frac{\text{RDL}}{\text{DDM}}$ to turn off DATA ENTRY—f and then make entry.
   (b) When stepping DDM's, DATA ENTRY—f key can stay on. Press FUNCTION CONTROL—STD key or DATA ENTRY—$\frac{0}{60°}$ key to disable phase shift.



View F. ILS Phase Adjustment

g. Removal of 90- or 150-Hz Audio Modulation for Flag Check

Either the 90- or 150-Hz ILS audio tone or both tones can be removed to perform a flag check or for other tests. Press the TONE SELECT—90-Hz or 150-Hz key to remove the applicable audio modulation. When the modulation is off, the key light turns off. To turn on the modulation, press the applicable key. Refer to view G.



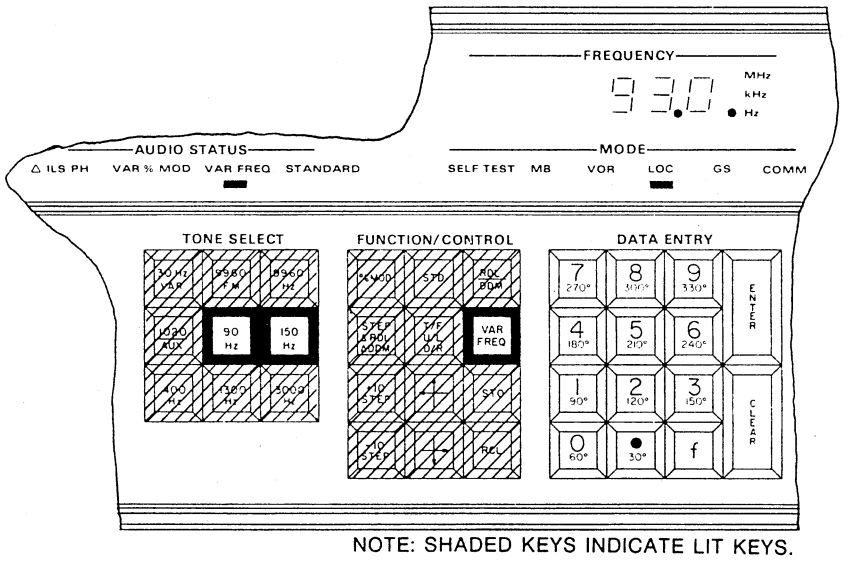
View G. 90-Hz/150-Hz Removal

ILS DDM Selection and Adjustment
Figure 11 (Sheet 3)

h. Adjusting the 90- and 150-Hz Audio Modulation Frequency

The 90- and 150-Hz frequencies are variable ±5 percent. Refer to view H.

1. Press the FUNCTION/CONTROL—VAR FREQ key. The key will light and the VAR FREQ indicator will light.
2. Press the TONE SELECT 90-Hz or 150-Hz keys to select desired frequency. The selected frequency will be displayed.
3. The tones may be deleted or added in the variable frequency mode by depressing the VAR FREQ key again. The signal generator will remain in the variable frequency mode. To make subsequent changes depress VAR FREQ key again.
4. Enter selected frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 92.5 Hz is desired, enter 92.5 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency. Press DATA ENTRY ENTER key to enter selected frequency in signal generator circuits.
5. New frequency will be displayed. To observe frequency of other tone, press TONE SELECT 90-Hz and 150-Hz keys to select other tone. Adjusting either tone will cause a corresponding change in the other. For example, changing 90-Hz 2 percent to 91.8 will cause the 150-Hz to also change 2 percent to 153-Hz.



View H. 90-Hz/150-Hz Adjustments

ILS DDM Selection and Adjustment
Figure 11 (Sheet 4)

i. Audio Tone Addition

A preset 1020-Hz or an auxiliary 30-Hz to 4-kHz audio tone may be added to the localizer signal. For special test purposes 10- to 30-Hz and 4- to 10-kHz audio tones may also be added. The preset 1020-Hz audio tone cannot be added to the glideslope signal. Refer to view I.

1. Preset 1020-Hz Audio Tone (Localizer Only)

Press TONE SELECT 1020/AUX key. Key lights and a 1020-Hz audio tone is added to the localizer signal if VAR FREQ key is not lit. Press key again to remove audio tone.

2. AUX (30-Hz to 4-kHz) Audio Tone

(a) Press FUNCTION/CONTROL—VAR FREQ key. Key lights and VAR FREQ indicator lights. Press STD key to turn off.

(b) Press TONE SELECT 1020/AUX key. Key lights and a 1000-Hz audio tone is added to the localizer or glideslope signal and displayed on the FREQUENCY indicator. To turn off AUX audio tone, depress FUNCTION/CONTROL—VAR FREQ key followed by TONE SELECT 1020/AUX key. If VAR FREQ is pressed while 1020 is on, the 1020 will go off.

(c) Frequency Adjustments

The frequency can be adjusted from 30 Hz to 4 kHz. Entries that would exceed the range cause the FREQUENCY indicator to flash and AUX frequency to remain at last valid entry. Pressing any front panel key causes flashing to cease.

Note

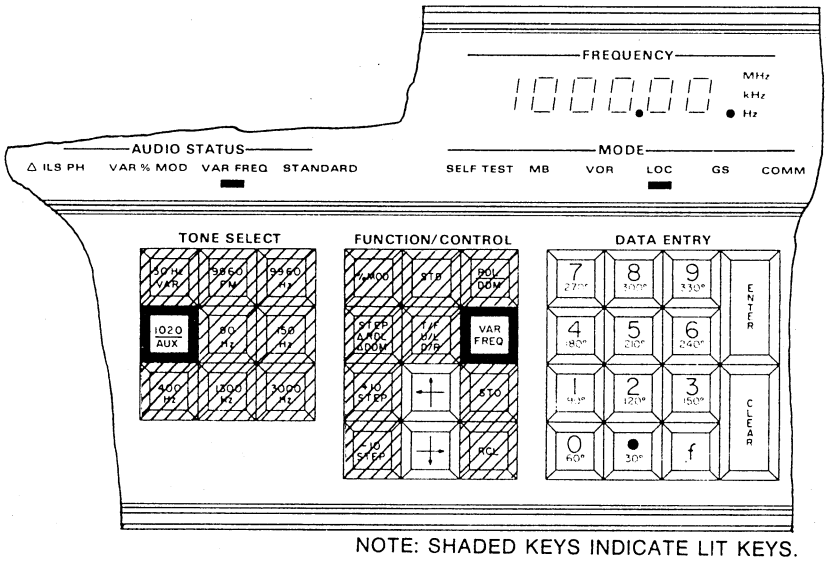
Entries from 10 to 30 Hz and from 4 to 10 kHz are also allowed for special test purposes and will not cause the FREQUENCY indicator to flash.

(1) Frequency Selection

Enter selected audio frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 25.5 Hz is desired, enter 25.5 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency. Press DATA ENTRY—ENTER key to enter selected audio frequency in signal generator.

(2) AUX Audio Frequency Slewing

Press FUNCTION/CONTROL—◄╋►key once for each step increase desired. Holding key depressed provides continuous frequency increase. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-steps below 1000 Hz. Press FUNCTION/CONTROL—╋key once for each step decrease desired. Holding key depressed provides continuous frequency decrease. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz.



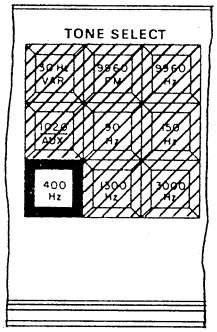
NOTE: SHADED KEYS INDICATE LIT KEYS.

View I. Audio Tone Selection

ILS DDM Selection and Adjustment
Figure 11 (Sheet 5)

3.9 Marker Beacon Marker Selection (Refer to figure 12.)

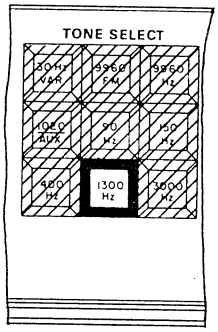
The outer beacon marker (400 Hz) is automatically selected when a marker beacon frequency is selected and the signal generator is placed in the preset condition for the marker beacon mode. Refer to view A.



View A. Outer Marker Selection

a. Selection of Middle Marker*

Press TONE SELECT—1300 Hz key and key lights. The 400-Hz and 3000-Hz keys are not lit. Refer to view B.



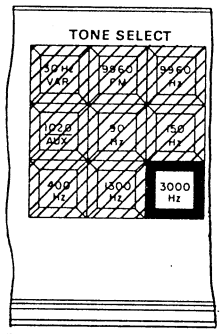
View B. Middle Marker Selection

b. Selection of Inner Marker*

Press TONE SELECT—3000 Hz key and key lights. The 400-Hz and 1300-Hz keys are not lit. Refer to view C.

c. Selection of Outer Marker*

Press TONE SELECT—400 Hz key and key lights. The 1300-Hz and 3000-Hz keys are not lit. Refer to view A.



NOTE: SHADED KEYS INDICATE LIT KEYS.

View C. Inner Marker Selection

Marker Beacon Tone Selection
Figure 12 (Sheet 1 of 2)

*All marker beacon tones may be removed if desired.

d. AUX Tone Selection

An auxiliary audio tone may be used in place of the standard audio marker beacon frequencies for specialized tests. Refer to view D.

1. Press FUNCTION/CONTROL—VAR FREQ key. Key lights and VAR FREQ indicator lights.
2. TONE SELECT—1020/AUX key lights, the preset 400-, 1300-, or 3000-Hz tone is automatically deleted (if present) and a 1000-Hz audio tone replaces the marker beacon signal and is displayed on the FREQUENCY indicator.
3. Frequency Adjustments

   The frequency can be adjusted from 100 Hz to 4000 Hz. Entries that would exceed the range cause the FREQUENCY indicator to flash and AUX frequency to remain at last valid entry. Pressing any front panel key causes flashing to cease.

Note

Entries from 10 to 100 Hz and from 4 to 10 kHz are also allowed for special test purposes and will not cause the FREQUENCY indicator to flash.

(a) Frequency Selection

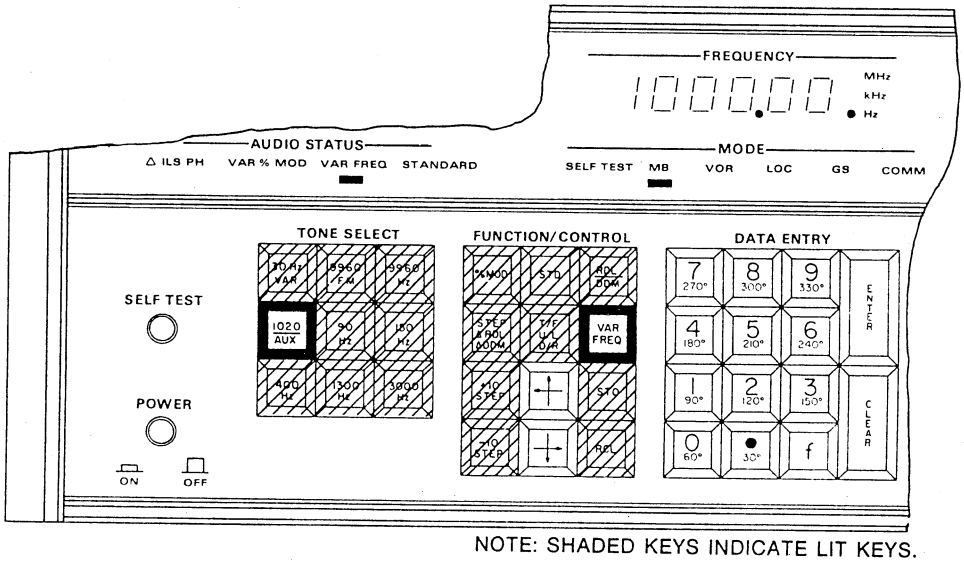
Enter selected audio frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 375.5 Hz is desired, enter 375.5 on the DATA ENTRY keys. Of an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency.

(b) AUX Audio Frequency Slewing

Press FUNCTION/CONTROL ◄┼► key once for each step increase desired. Holding key depressed provides continuous frequency increase. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz. Press FUNCTION/CONTROL ┼► key once for each step decrease desired. Holding key depressed provides continuous frequency decrease. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz.

e. Interference Check

The standard marker ground station frequency is 75.000 MHz. In the marker beacon mode, the signal generator is capable of producing rf frequencies from 74.6 to 75.4 MHz to provide generation of interference-type signals. Signal frequencies are selected through the DATA ENTRY keys.



View D. AUX Tone Selection

Marker Beacon Tone Selection
Figure 12 (Sheet 2)

3.10 Communication Mode Tone Selection (Refer to figure 13.)

The 1020-Hz tone is automatically selected when a communication rf frequency is selected and the signal generator is placed in the preset condition for communication mode. An auxiliary audio tone may be used in place of the 1020-Hz tone.

a. Selection of AUX Tone

Press FUNCTION/CONTROL—VAR FREQ key. Key lights, VAR FREQ indicator lights, 1020/AUX key lights (if off), and a 1000-Hz audio tone is displayed on the FREQUENCY indicator. To turn off AUX audio tone, depress FUNCTION/CONTROL—VAR FREQ key followed by TONE SELECT—1020/AUX key.

b. AUX Tone Frequency Adjustments

The AUX tone may be varied from 30 Hz to 10 kHz. Entries that would exceed the range cause the FREQUENCY indicator to flash and AUX frequency to remain at last valid entry. Pressing any front panel key causes flashing to cease.

Note

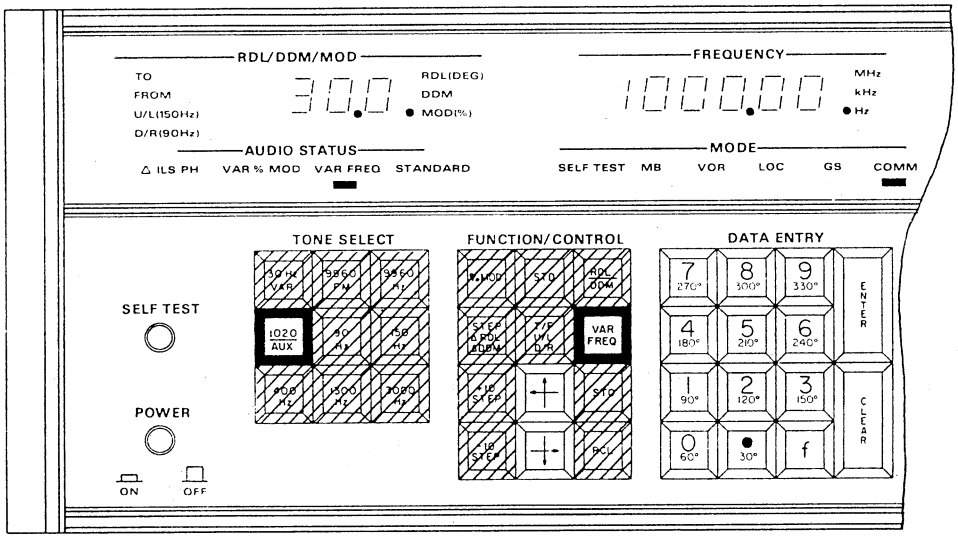
Entries from 10 to 30 Hz are also allowed for special test purposes and will not cause the FREQUENCY indicator to flash.

1. Frequency Selection

Enter selected audio frequency on DATA ENTRY numerical keys. The decimal point must be entered explicitly. For example, if 375.5 Hz is desired, enter 375.5 on the DATA ENTRY keys. If an error is made during the entry and before the ENTER key is pressed, press CLEAR key to remove incorrect entry and reenter correct frequency.

2. AUX Audio Frequency Slewing

Press FUNCTION CONTROL ← key once for each step increase desired. Holding key depressed provides continuous frequency increase. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz. Press FUNCTION CONTROL → key once for each step decrease desired. Holding key depressed provides continuous frequency decrease. Slewing is in 1.0-Hz steps above 1000 Hz and in 0.1-Hz steps below 1000 Hz.



COMM Mode AUX Tone Selection
Figure 13

3.11 Percent Modulation Adjustment (Refer to figure 14.)

In the preset condition for each mode of operation, the percent modulation is set to the accepted standard. The percent modulation can be varied from the standard in both directions in 0.1-percent steps. Table 12 lists the percent modulation for the preset condition and variable range with respect to each mode of operation.

Note

The 1020-Hz audio tone amplitude modulation is a fixed 30 percent in the VOR localizer and vhf communication modes. The 1020-Hz tone is not present in the glideslope or marker beacon mode.

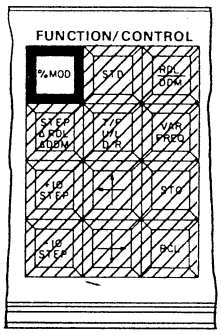
Table 12. Percent Modulation Chart.

MODE	PERCENT MODULATION	
	PRESET CONDITION	VARIABLE RANGE
VOR		
30 Hz VAR	30.0	5.0 to 35.0
9960 Hz FM	30.0	5.0 to 35.0
AUX audio	30.0	5.0 to 35.0
Localizer		
90/150 Hz	20.0	5.0 to 40.0
AUX audio	30.0	5.0 to 30.0
Glideslope		
90/150 Hz	40.0	10.0 to 80.0
AUX audio	30.0	10.0 to 60.0
Marker Beacon		
400/1300/3000 Hz	95.0	15.0 to 97.0
AUX audio	95.0	15.0 to 97.0
Communication		
AUX audio	30.0	5.0 to 35.0

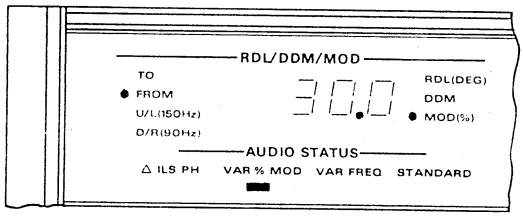
a. Press FUNCTION/CONTROL—% MOD key to enable entry of data through the DATA ENTRY keys. Refer to view A. The key lights when percent modulation data entry is enabled and remains lit until the FUNCTION/CONTROL—RDL/DDM, VAR FREQ, or STD key, the RF SELECT—RF FREQ key or DATA ENTRY—f key is pressed.
b. RDL/DDM/MOD display indicates percent modulation for the preset condition. In marker beacon and communication mode, the percent modulation is displayed on the selection of the marker beacon or a communication rf frequency without pressing the % MOD key. Refer to view B.
c. The AUDIO STATUS—VAR % MOD indicator lights indicating the generator is in the variable % modulation mode.
d. Press TONE SELECT key for the desired tone. In the VOR mode, upon initial selection of % MOD with both 30-Hz VAR and 9960-Hz selected (on) the modulation of both tones may be adjusted simultaneously if neither tone select key is pressed. Pressing either the 30-Hz VAR, 9960 FM, or 9960 Hz TONE SELECT key will enable individual tone mdoulation. The FREQUENCY display will indicate the modulating frequency to be adjusted. In localizer or glideslope modes, the 90/150-Hz tones are always adjusted simultaneously.
e. Enter selected percent modulation on DATA ENTRY numerical keys. Refer to view C. The decimal point entry must be entered explicitly. For example, if 27.8 percent modulation is desired, enter 27.8 on the DATA ENTRY keys. If an error is made during the entry of the selected percent modulation and before the ENTER key is pressed, press DATA ENTRY—CLEAR key to remove incorrect entry, and reenter correct percent modulation.
f. Press DATA ENTRY—ENTER key to enter selected percent modulation in signal generator circuits.
g. RDL/DDM/MOD display indicates the selected percent modulation. If display is flashing, the data entered is unacceptable. Press DATA ENTRY—CLEAR key to clear display, and repeat steps d through f.

Note

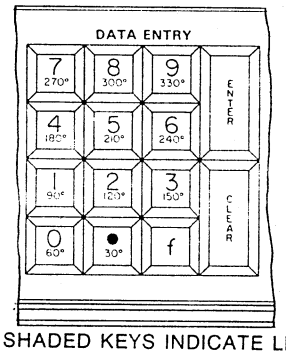
Depressing the FUNCTION/CONTROL—VAR FREQ key will cause % MOD key to extinguish and enable DATA ENTRY key for frequency adjustment.



View A. Percent Modulation Enable



View B. Percent Modulation Display and Audio Status



NOTE: SHADED KEYS INDICATE LIT KEYS.

View C. Percent Modulation Data Entry

Percent Modulation Adjustment
Figure 14

h. If it is desired to return the signal generator to the preset condition, press FUNCTION/CONTROL—STD key.

3.12 External Modulation Operation

The external modulation feature allows the operator to externally module the selected rf carrier frequency.

a. Select desired rf carrier frequency.
b. Connect an ac voltmeter to rear DEMOD BNC connector.
c. Select one preset tone on TONE SELECT keyboard.
d. Record level of ac voltmeter.
e. Delete tone selected in step c.
f. Connect modulating source to rear EXT MOD BNC connector and select desired frequency. (Refer to description section for limits.) Adjust level of modulating source until reading on ac voltmeter agrees with that recorded in step d. The percentage modulation of the external signal is now equal to that of the preset tone selected in step c.
g. To vary the modulation percentage, divide the desired modulation percentage by the preset modulation percentage of step c tone and then multiply by the ac reading of step d. The modulating source level is then adjusted until the ac voltmeter reads this new value.

Note

Steps b through g are accurate for modulation levels up to 85 percent. For levels above 85 percent and/or greater accuracy, an external modulation meter may be connected to the front panel rf connector. The external modulating source amplitude is then adjusted to produce the desired modulation percentage. Delete internal tones when setting.

3.13 Scope Trigger Operation

The scope trigger feature allows the operator to make time response measurements. An output pulse is provided coincident with any front panel keystroke. The output pulse is a positive going TTL compatible pulse approximately 8 μs in width. Output is available on rear panel REMOTE TUNE connector, pin 31.

3.14 Store/Recall Selection (Operational only on 479S-6A's with option 1 or 2 incorporated.)

a. Entry of DATA in Storage (Refer to figure 15, view A)

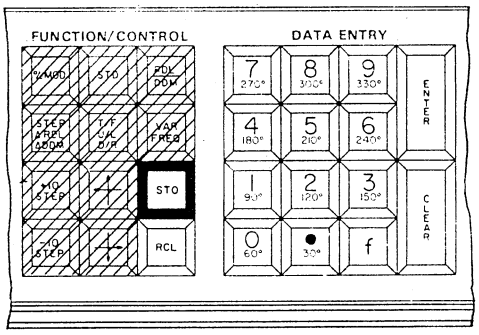
1. Select desired setup as described in previous paragraphs.
2. Press FUNCTION/CONTROL—STO key. The key light will come on. Any other modifier key that is lit will go out.
3. Press two DATA ENTRY keys for desired memory location, 00 to 99. Two keys must be selected to enter data in memory; for example, if memory number 03 is to be selected, enter 03 on the DATA ENTRY keys.
4. Data will be entered into storage and STO light will go out. A flashing STO light indicates incorrect storage or a faulty memory location. Pressing any front panel key will cause the light to cease flashing.

b. Recalling of Data From Storage (Refer to figure 15, view B).

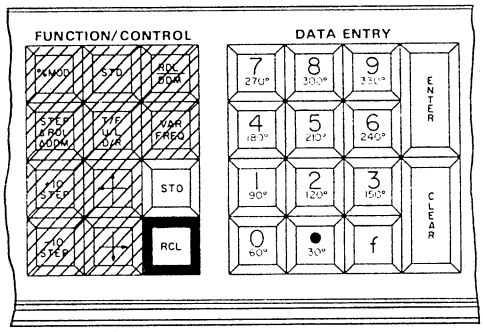
1. PRESS FUNCTION/CONTROL—RCL key. The key light will come on.
2. Press two DATA ENTRY keys for memory location desired to recall. Two keys must be selected to recall data in memory; for example, if memory number 03 is to be recalled, enter 03 on the DATA ENTRY keys.
3. Additional memory locations can be recalled by entering the 2-digit memory location on the DATA ENTRY keyboard as long as the RCL key is lit. To extinguish the light, select any other function requiring use of the DATA ENTRY keyboard.

c. Revising Data Stored in Memory

Perform procedure for entering data in storage.



View A. Entry of Data in Storage



NOTE: SHADED KEYS INDICATE LIT KEYS.

View B. Recall of Data From Storage

Store/Recall Selection
Figure 15

3.15 IEEE Operation (Optional only on 479S-6A's with option 2 or 3 incorporated).

3.15.1 General

This paragraph provides operational instructions for the IEEE Interface Card A10. Paragraph 3.15.2 applies only to 479S-6A units with A10 CPN 601-5883-001. Paragraph 3.15.3 applies to 479S-6A units with A10 CPN 601-2309-001.

Because IEEE bus data lines D6 and D7 are not decoded while an address byte appears on the bus, certain talk/listen addresses cannot be distinguished from the following addressed or universal commands.

ADDRESSED COMMANDS		UNIVERSAL COMMANDS	
GTL	go to local	LLO	local lockout
SDC	selected device clear	DCL	device clear
PPC	parallel poll configure	PPU	parallel poll unconfigure
GET	group execute trigger	SPE	serial poll enable
TCT	take control	SPD	serial poll disable

Table 13 contains the talk/listen addresses which should be avoided when configuring for IEEE bus operations.

Table 13. Restricted Addresses for 479S-6A.

IEEE DATA BUS							LISTEN ADDRESS	TALK ADDRESS
D7	D6	D5	D4	D3	D2	D1		
X	X	0	0	0	0	1	!	A
X	X	0	0	1	0	0	$	D
X	X	0	0	1	0	1	%	E
X	X	0	1	0	0	0	(	H
X	X	0	1	0	0	1	)	I
X	X	1	0	0	0	1	1	Q
X	X	1	0	1	0	0	4	T
X	X	1	0	1	0	1	5	U
X	X	1	1	0	0	0	8	X
X	X	1	1	0	0	1	9	Y

3.15.2 IEEE Operation for Units with A10 CPN 601-5883-001 Installed

The signal generator may be remotely controlled via the IEEE standard digital interface for programmable instrumentation (IEEE STD-488/1975).

a. General

In general, the signal generator may be programmed remotely in the same manner as manually. That is, sequential data characters are transmitted in the proper order and content the same as if the signal generator front-panel keys were being pushed manually. Certain manual keystrokes are not emulated remotely when the manual function was to provide "operator convenience" features (that is, +10 and -10 degree bearing step keys). Additionally, the rf attenuation level is programmed directly from the remote controller instead of emulating the FAST INCR, SLOW INCR, FAST DECR, and SLOW DECR keystrokes. It must also be noted that, since several of the keys provide a toggle function, the programmer must keep track of the previous state of these keys or an incorrect result could be obtained.

b. Address Selection

Address selection for the signal generator is provided internally on IEEE 488 interface assembly A10. The signal generator is shipped from the factory preset to:

X X 1 0 1 1 0

b7 b6 b5 b4 b3 b2 b1

Per appendix E of IEEE STD-488/1978, this corresponds to a LISTEN address of "6" and a corresponding TALK address of "V."

c. Address Selection Switch

A 5-position DIP switch on assembly A10 can be reset to select another address. Viewed from the component side of the A10 assembly, the switches are arranged from left (MSB) to right (LSB) to correspond with the lower order bits of the ASCII data bus. A closed switch indicates logic 0 on the ASCII data bus and an open switch indicates logic 1.

3.15.2.1 Listener Interface Function

a. General

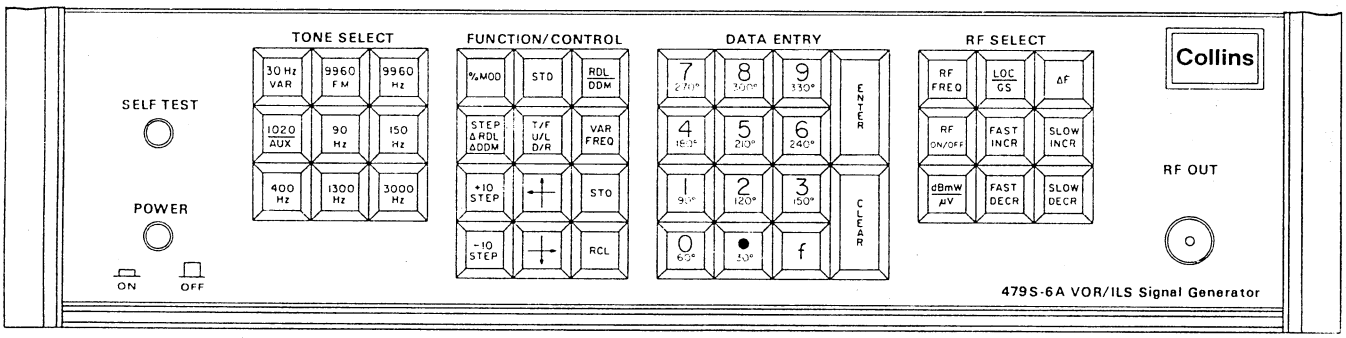
The signal generator can receive device dependent data over the interface when addressed to listen.

b. Syntax (Refer to figure 16)

The following ASCII characters and their associated functions are recognized by the signal generator when in the LISTEN mode.

CHARACTER RECEIVED	KEYSTROKE EMULATED	CHARACTER RECEIVED	KEYSTROKE EMULATED
		@	STD
/	T/F, U/L, D/R	A	* N/A
0	0	B	* N/A
1	1	C	CLEAR
2	2	D	RDL/DDM
3	3	E	ENTER
4	4	F	RF FREQ
5	5	G	30 Hz VAR
6	6	H	9960 FM
7	7	I	9960 Hz
8	8	J	1020/AUX
9	9	K	90 Hz
:	SELFTEST	L	150 Hz
;	VAR FREQ	M	%MOD
<	RCL	N	400 Hz
=	DELTA F	O	RF ON/OFF
>	STO	P	1300 Hz
?	f	Q	3000 Hz

*Rf attenuation is programmed directly. See text for definition and usage of these two symbols.



Front-Panel Switches
Figure 16

c. Operation

1. When transmitting device dependent data to the signal generator, a carriage return character followed by a line feed character must be transmitted following the last byte in the message string.
2. When power is first applied to the signal generator, the generator IEEE bus interface circuits are initialized but the unit remains under manual (front-panel) control. The first time the signal generator is addressed by the remote controller, however, the unit reverts to automatic mode and the front-panel keyboard is locked out (including the self-test switch). The front-panel displays, key lamps, and status indicators continue to operate. The unit will remain in the remote mode (even if unaddressed) until power is removed. The only exception occurs when the unit is remotely commanded into a self-test. After completion of the self-test, the unit will revert to the power-up mode and manual operation. The keyboard lockout function does not rely on nor employ any of the messages associated with the remote local (RL) interface function. The REN bus management interface line is not utilized.
3. A complete front-panel setup can be transmitted before the carriage return-line feed characters (that is, rf frequency, followed by rf level, followed by a bearing or DDM selection, etc). Individual parameters can also be transmitted; however, following each carriage return-line feed, the signal generator will not

release the IEEE bus until it has completed processing the last message string received (that is, the NDAC interface line is held low).

4. Rf level data is programmed directly into the signal generator. Two basic modes are available:
   (a) The signal generator can be programmed in the dB mW mode. In this mode, the RF LEVEL display indicates in -dB mW and displays the actual rf level as measured at the rf output connector of the generator. Rf level is programmed by transmitting an A, followed by a 1-, 2-, or 3-digit number representing the desired rf level expressed in dB. (Examples: A6, A50, A120.) Allowed range is 6 to 120, corresponding to rf levels of -6 to -120 dB mW respectively.
   (b) In the "hard μV" mode, level is displayed in hard μV, and the level at the generator rf output if 6 dB lower than that displayed. (This eliminates the need for an external 6-dB pad.) Rf level is programmed by transmitting an A, followed by a 1-, 2-, 3-digit number representing the dB equivalent for the hard μV level desired, followed by a "B." The signal generator will automatically insert an additional 6 dB, simulating an external 6-dB pad. For example, a level of 5 μV ("hard μV") is required. The equivalent level, in dB, corresponding to 5 μV is -93 dB mW; thus the generator is programmed to A93B. The rf level display indicates 5 μV and the signal generator output level is 2.5 μV.
5. The device clear (DC) and device trigger (DT) interface functions are not used.
6. The interface clear (IFC) and end or identify (EOI) bus management interface lines are not used.

3.15.2.2 Talker Interface Function

a. General

The signal generator may function as a TALK device under two very specific conditions: (1) to transmit the results of a self-test sequence; and (2) to respond to a serial poll when the service request (SRQ) bus management interface line is set TRUE (logic 0).

b. Self-Test Status

1. The remote controller can initiate a self-test of the signal generator. The generator is first addressed as a LISTEN device; the test command character ":" is then sent. The generator then will enter the self-test mode, which requires approximately 15 seconds. During this interval, the signal generator ROM and RAM memory is tested, the rf frequency is tested, the digital waveform generator is tested by programming a VOR 0 degree bearing into it and requiring a valid response (phase indication), and, lastly, the PH LOCK and LEVEL CAL statuses are determined. At the termination of the self-test, the internal CPU reprograms the signal generator to the power-up condition (refer to description section, paragraph 8.3) and restores signal generator operation to the manual mode. At this point, the remote controller can resume executing its normal program or request the self-test results from the signal generator.
2. To request self-test results, the remote controller addresses itself to listen, then sends the talk address of the signal generator. For a valid self-test, the signal generator will reply with the following ASCII character string:

P L F B

First byte ↑

3. The intelligence conveyed by the ASCII character string is as follows:

CHARACTER TRANSMITTED	FUNCTION
P	Successful self-test of the signal generator rf synthesizer phase-lock status
L	Successful self-test of the signal generator rf level status
F	Successful self-test of the signal generator rf frequency
B	Successful self-test of the signal generator audio VOR bearing phase
E	Transmitted in place of any or all of the above characters upon a self-test failure

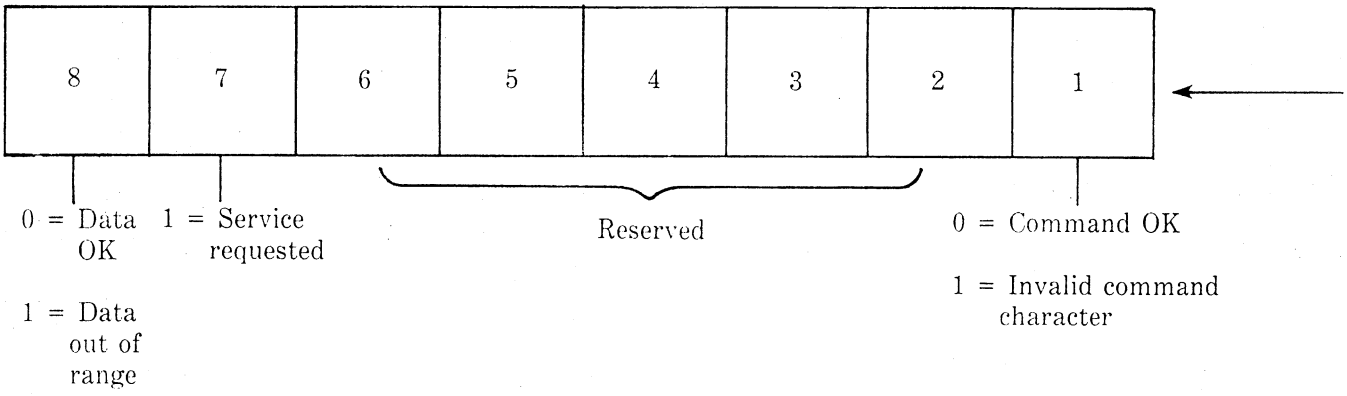
4. The signal generator holds control of the bus during the entire self-test interval by holding the NDAC line low. (This is also true during

normal ATE operation whenever the signal generator is processing a complete character string.) If either the ROM or RAM check fails during the self-test interval, the signal generator will enter a "flash display" loop routine and will never allow the NDAC line to go high, thus the self-test pass-fail status is automatically annunciated.

5. Results of the self-test should not be requested by the controller until completion of the entire self-test interval, or an erroneous or failed condition may occur.

c. Service Request and Serial Polling

1. A request for service (SRQ) will be generated asynchronously whenever the signal generator detects invalid data (that is, an "out-of-range" rf frequency) or an invalid command character.
2. The signal generator sets the SRQ bus management interface line TRUE (logic 0) and, when addressed during a serial poll, transmits a status byte to the controller. The format is as follows:



STATUS BYTE

(a) Data bit 1 will be 1 if an invalid command character was received by the signal generator. The remote controller must then repeat the entire character string.

(b) Data bits 2 through 6 are reserved for future applications and may be in either the 1 or 0 states independently.

(c) Bit 7 will be a 1 indicating service was requested.

(d) Bit 8 will be 1 if out-of-range data is received by the signal generator (that is, an invalid rf frequency character was inadvertently transmitted). The remote controller must then repeat the entire character string.

3. During a serial poll sequence, the signal generator does not recognize either the serial poll enable (SPE) or serial poll disable (SPD) universal commands, but instead monitors the state of the SRQ line. Consequently, the controller should not request the status byte from the signal generator while the SRQ line is FALSE (logic 1) or an incorrect or failed condition may occur on the bus.
4. If any other device on the bus requests service from the controller (by setting SRQ = TRUE, or logic 0), the signal generator will, when addressed during a serial poll, respond with the status byte. Bit 7 will be 0, indicating service was not requested by the generator. Bits 1 and 8 will likewise be 0.
5. The parallel poll (PP) interface function is not used.

3.15.3 IEEE Operation for Units with A10 CPN 601-2309-001 Installed

The signal generator may be remotely controlled via the IEEE standard digital interface for programmable instrumentation (IEEE STD-488/1978).

a. General

In general, the signal generator may be programmed remotely in the same manner as manually. That is, sequential data characters are transmitted in the proper order and content the same as if the signal generator front-panel keys were being pushed manually. Certain manual keystrokes are not emulated remotely when the manual function was to provide "operator convenience" features (that is, +10 and -10 degree bearing step keys). Additionally, the rf attenuation level is programmed directly from the remote controller instead of emulating the FAST INCR, SLOW INCR, FAST DECR, and SLOW DECR keystrokes. It must also

be noted that, since several of the keys provide a toggle function, the programmer must keep track of the previous state of these keys or an incorrect result could be obtained.

b. Address Selection

Address selection for the signal generator is provided internally on IEEE 488 interface assembly A10. The signal generator is shipped from the factory preset to:

0	1	1	0	1	X	X
b1	b2	b3	b4	b5	b6	b7

Per appendix E of IEEE STD-488/1978, this corresponds to a LISTEN address of "6" and a corresponding TALK address of "V".

c. Address Selection Switch

A 5-position DIP switch on assembly A10 can be reset to select another address. Viewed from the component side of the A10 assembly, the switches are arranged from right (MSB) to left (LSB) to correspond with the lower order bits of the ASCII data bus. A closed switch indicates logic 1 on the ASCII data bus and an open switch indicates logic 0.

d. GPIB Functions Implemented

The following functions are implemented per IEEE STD-488/1978:

AH1 — Complete acceptor handshake capability

SH1 — Complete source handshake capability

T6 — Basic talker, serial poll, unaddress if MLA, no talk only mode

L4 — Basic listener, unaddress if MTA, no listen only mode

SR1 — Complete service request capability

RL2 — Remote-local capability, no local lockout

DC1 — Complete device clear capability

Not implemented:

TEØ — Extended talker

LEØ — Extended listener

PPØ — Parallel poll

DTØ — Device trigger

CØ — Controller

3.15.3.1 Listener Interface Function

a. General

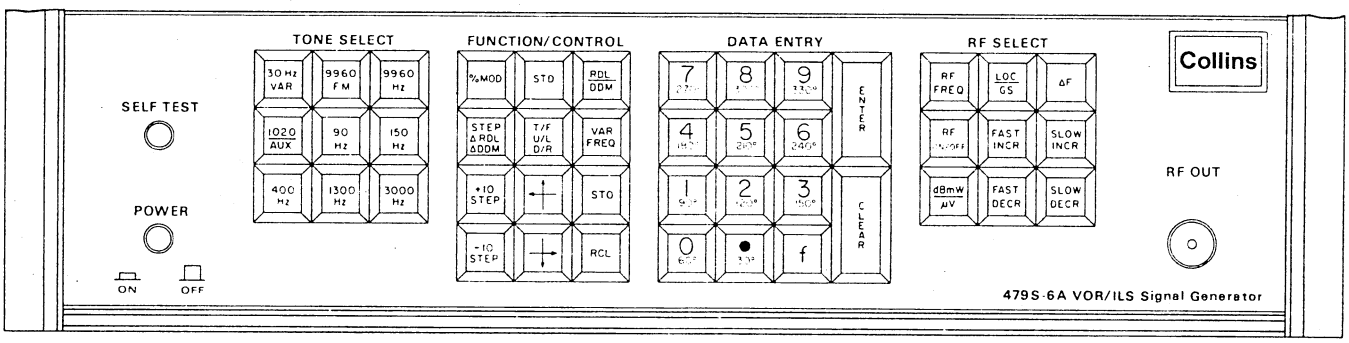
The signal generator can receive device dependent data over the interface when addressed to listen.

b. Syntax (Refer to figure 17)

The following ASCII characters and their associated functions are recognized by the signal generator when in the LISTEN mode.

CHARACTER RECEIVED	KEYSTROKE EMULATED	CHARACTER RECEIVED	KEYSTROKE EMULATED
.	.	@	STD
/	T/F, U/L, D/R	A	* N/A
0	0	B	* N/A
1	1	C	CLEAR
2	2	D	RDL/DDM
3	3	E	ENTER
4	4	F	RF FREQ
5	5	G	30 Hz VAR
6	6	H	9960 FM
7	7	I	9960 Hz
8	8	J	1020/AUX
9	9	K	90 Hz
:	SELFTEST	L	150 Hz
;	VAR FREQ	M	%MOD
<	RCL	N	400 Hz
=	DELTA F	O	RF ON/OFF
>	STO	P	1300 Hz
?	f	Q	3000 Hz

*Rf attenuation is programmed directly. See text for definition and usage of these two symbols.



Front-Panel Switches
Figure 17

c. Operation

1. When transmitting device dependent data to the signal generator, a carriage return character followed by a line feed character must be transmitted following the last byte in the message string.
2. A complete front-panel setup can be transmitted before the carriage return-line feed characters (that is, rf frequency, followed by rf level, followed by a bearing or DDM selection, etc). Individual parameters can also be transmitted: however, following each carriage return-line feed, the signal generator will not release the IEEE bus until it has completed processing the last message string received (that is, the NDAC interface line is held low).
3. Rf level data is programmed directly into the signal generator. Two basic modes are available:
   (a) The signal generator can be programmed in the dB mW mode. In this mode, the RF LEVEL display indicates in -dB mW and displays the actual rf level as measured at the rf output connector of the generator. Rf level is programmed by transmitting an A, followed by a 1-, 2-, or 3-digit number representing the desired rf level expressed in dB. (Examples: A6, A50, A120.) Allowed range is 6 to 120, corresponding to rf levels of -6 to -120 dB mW respectively.
   (b) In the "hard μV" mode, level is displayed in hard μV, and the level at the generator rf output if 6 dB lower than that displayed. (This eliminates the need for an external 6-dB pad.) Rf level is programmed by transmitting an A, followed by a 1-, 2-, 3-digit number representing the dB equivalent for the hard μV level desired, followed by a "B". The signal generator will automatically insert an additional 6 dB, simulating an external 6-dB pad. For example, a level of 5 μV ("hard μV") is required. The equivalent level, in dB, corresponding to 5 μV is -93 dB mW; thus the generator is programmed to A93B. The rf level display indicates 5 μV and the signal generator output level is 2.5 μV.

3.15.3.2 Talker Interface Function

a. General

The signal generator may function as a TALK device under two very specific conditions: (1) to transmit the results of a self-test sequence; and (2) to respond to a serial poll when the service request (SRQ) bus management interface line is set TRUE (logic 0).

b. Self-Test Status

1. Upon initial power up, the GPIB interface is inactive until self-test is complete. Anytime thereafter when a self-test is initiated, GBIP interface remains active but the bus is held off. Any attempt to initiate a listen function during self-test is ignored following the first bit sent down the bus. Once self-test is completed the signal generator reverts to the power-up state which reinitializes the GPIB interface allowing talker interface functions.
2. The remote controller can initiate a self-test of the signal generator. The generator is first addressed as a LISTEN device; the test command character ":" is then sent. The generator then will enter the self-test mode, which requires approximately 15 seconds. During this interval, the signal generator ROM and RAM memory is tested, the rf frequency is tested, the digital

waveform generator is tested by programming a VOR 0 degree bearing into it and requiring a valid response (phase indication), the PH LOCK and LEVEL CAL statuses are determined, and lastly the bus interface is disabled. At the termination of the self-test, the internal CPU reprograms the signal generator to the power-up condition (see description section, paragraph 8.3) and restores signal generator operation to the manual mode. At this point, the remote controller can resume executing its normal program or request the self-test results from the signal generator.

3. To request self-test results, the remote controller addresses itself to listen, then sends the talk address of the signal generator. For a valid self-test, the signal generator will reply with the following ASCII character string:

P L F B

First byte ↑

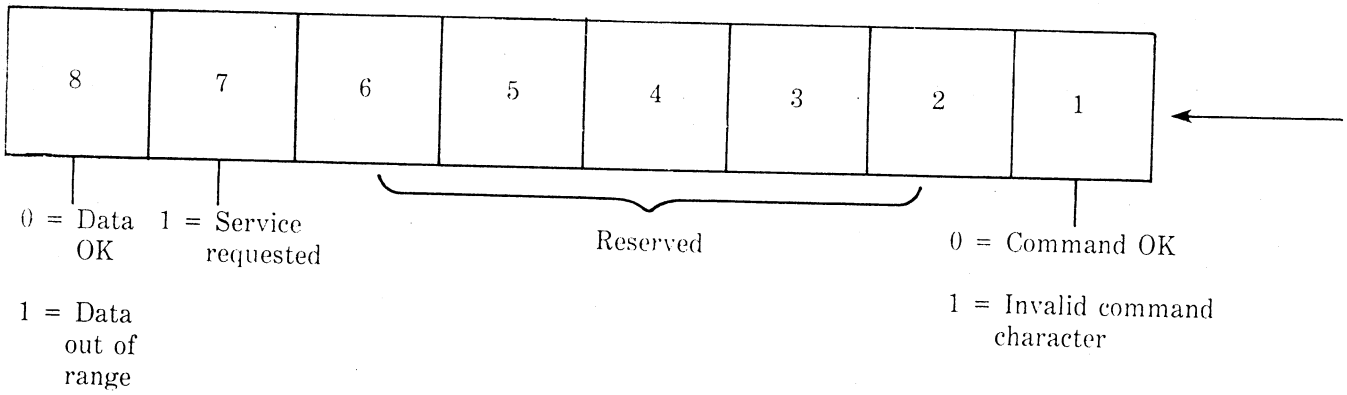
The intelligence conveyed by the ASCII character string is as follows:

CHARACTER TRANSMITTED	FUNCTION
P	Successful self-test of the signal generator rf synthesizer phase-lock status
L	Successful self-test of the signal generator rf level status
F	Successful self-test of the signal generator rf frequency
B	Successful self-test of the signal generator audio VOR bearing phase
E	Transmitted in place of any or all of the above characters upon a self-test failure

3.15.3.3 Service Request Interface Function

a. Service Request and Serial Polling

1. A request for service (SRQ) will be generated asynchronously whenever the signal generator detects invalid data (that is, an "out-of-range" rf frequency) or an invalid command character.
2. The signal generator sets the SRQ bus management interface line TRUE (logic 0) and, when addressed during a serial poll, transmits a status byte to the controller. The format is as follows:



STATUS BYTE

(a) Data bit 1 will be 1 if an invalid command character was received by the signal generator. The remote controller must then repeat the entire character string.
(b) Data bits 2 through 6 are reserved for future applications and may be in either the 1 or 0 states independently.
(c) Bit 7 will be a 1 if service was requested.
(d) Bit 8 will be 1 if out-of-range data is received by the signal generator (that is, an invalid rf frequency character was inadvertently transmitted). The remote controller must then repeat the entire character string.

3.15.3.4 Device Clear Interface Function

The device clear interface function provides the signal generator with the capability to be cleared (initialized).

Sending the universal bus command "DCL" (device clear — hex code 14) or the addressed bus command "SDC" (selective device clear — hex code Ø4) will return the signal generator to the power-up state, with the exception of remaining in the remote mode.

3.15.3.5 Remote-Local Interface Function

Upon power-up, the 479S-6A will be in the local mode (front panel is activated). The first time the signal generator is addressed to listen with the remote enable (REN) bus control line true, the signal generator will enter the remote mode. In this mode the bus has control and the front-panel keyboard is locked out (except for the power switch). If the signal generator is addressed to listen with the REN line false, the signal generator will remain in the local mode and the generator will handshake in but ignore all data on the bus. Addressing the signal generator to talk has no effect on the remote-local status. When the generator is in the remote mode, it may be returned to the local mode in one of three ways:

a. Initiate a power-up state. This may be done by sending either the self-test command ":" or one of the bus commands "DEC" or "SDC".
b. Address the signal generator to listen and send the addressed bus command "GTL" (go to local-hex code Ø). This will not change any conditions set up on the signal generator, but will return the front panel to the active state.
c. Set the REN line to a false state. The signal generator will respond to this in the same way as a "GTL" command.

The signal generator has no "local lockout" capability.

3.15.3.6 Other Interface Functions

Bus commands associated with functions not used, as well as undefined bus commands, will be ignored by the signal generator.

3.15.4 IEEE Programming Examples

a. Example Number 1

The following example demonstrates how the signal generator can be programmed to perform rf sensitivity measurements (s+n/n) at several different frequencies.

DESIRED CONDITION	DATA	COMMENTS
NA	NA	All programs begin with generator in the power-up condition (see description section, paragraph 8.3).
1. 329.15 MHz	F329.15E	
2. 5 μV	A93B	Hard μV; display reads 5 μV.
4. 150 Hz only	K	90 Hz is removed. This is only necessary the first time the glideslope mode is activated. Subsequent rf frequency selections in the glideslope band will not require this command.
5. 30% modulation	ML30E	
6. NA	NA	Take signal-plus-noise reference reading.
7. No modulation	ML	150-Hz tone is removed.
8. NA	NA	Measure noise and compute result.
9. 330.35 MHz modulated 30% with 150 Hz	F330.35EL	Rf level and modulation remains unchanged from previous glideslope frequency; L restores 150 Hz at 30% modulation.
10. No modulation	L	
11. NA	NA	Measure noise level and compute result.
12. 332 MHz modulated 30% by 150 Hz (rf level to be 100 μV)	F332ELA67B	Display reads 100 μV. Generator output is 50 μV.
13. NA	NA	Record signal-plus-noise reading.
14. No modulation	L	
15. NA	NA	Record noise level and compute result.

b. Example Number 2

The following example demonstrates how the signal generator may be programmed to perform rf selectivity measurements.

DESIRED CONDITION	DATA	COMMENTS
1. 110.10 MHz, unmodulated, rf level 4 μV (hard μV)	F110.1EKLA95B	
2. NA	NA	Record AGC level as a reference.
3. 110.008 MHz, 8 μV	=110.088EA89B	
4. NA	NA	Reading is taken at f_c - 12 kHz (6-dB point).
5. 110.112 MHz	110.112E	
6. NA	NA	Reading is taken at f_c + 12 kHz (6-dB point).
7. 110.137 MHz, rf level 4 mV (hard μV)	110.137EA35B	
8. NA	NA	Reading is taken at f_c + 37 kHz (60-dB point).
9. 110.063 MHz	110.063E	
10. NA	NA	Reading is taken at f_c - 37 kHz (60-dB point).

c. Example Number 3

The following example programs the signal generator for ILS on-center and off-course DDM's. Both 90 > 150 and 150 > 90 Hz situations are illustrated.

DESIRED CONDITION	DATA	COMMENTS
1. 332 MHz, 700 μV (hard μV), standdard centering signal	F332EA50B	Upon initial selection of the glideslope mode, a standard on-center condition is established.
2. DDM.091, 90 > 150 Hz	D.091E/	Initial DDM selection upon entering glideslope mode will automatically be 150 > 90 Hz. T/F U/L D/R command toggles off-course DDM's to select predominating tone.
3. DDM.091, 150 > 90 Hz	/	
4. DDM.4, 150 > 90 Hz	D.4E	
5. DDM.4, 90 > 150 Hz	/	