MODEL 610

PRECISE

PRECISE DEVELOPMENT CORP.
Oceanside, L. I., N. Y.

GENERAL DESCRIPTION

Your MODEL 610 RF & TV MARKER GENERATOR is another example of "an engineered product" by PRECISE.
Here, embodied in one instrument, is the true example of engineering and design that has made PRECISE famous for ingenuity and quality.

The 610 is a general purpose signal generator for Radio & Television servicing and experimentation. One of the prime considerations was simplicity of operation, with the least possible number of controls being used.

Basically the instrument consists of a combined COLPITTS & ULTRA-AUDION oscillator feeding into a separate Buffer-Cathode-follower and finally through a low impedance attenuator to the output. The low frequency end of each oscillator range is individually tuned by varying the inductance. The high frequency setting of the variable capacitor is tuned by a trimmer.

Three basic forms of modulation are used: 1) 400 cycle from INTERNAL RC OSCILLATOR; 2) 60 cycle from the AC line; 3) EXTERNAL MODULATION through a special SPEECH AMPLIFIER.

The 400 cycle Audio is available at the output when the instrument is switched to the AF position. Its amplitude is variable by adjusting the output potentiometer.

The power supply consists of a transformer feeding into a Full Wave Rectifier and then into a pi filter.

To all above was included low-loss mica-filled sockets as needed, coaxial type output connectors; coaxial output leads; a completely separate high frequency chassis that shock absorbs and isolates the RF section; an illuminated drum dial; an etched panel design with a simplicity of operation as its keynote; and, ABOVE ALL, NEW PARTS directly from the manufacturer according to the rigid PRECISE specifications.

ELECTRICAL SPECIFICATIONS:

Power	22 watts
Voltage	105-125 volts
Line Frequency	50-60 cycles
Ranges:	RF
	300KC - 1MC Fundamentals
	1MC - 3MC "
	3MC - 10MC "
	10MC - 30MC "
	30MC - 110MC "
	90MC - 330MC 3rd Harmonic
	AF - 400 Cycles
Tubes:	1 - 6C4
	1 - 12AX7
	1 - 6X5

Mechanical Specifications:

Height	8"
Width	11"
Depth	5"
Weight	10 lbs
Panel	Slate grey, deeply etched aluminum with raised numerals
Cabinet	Baked, wrinkle grey steel
Handle	Genuine leather
Fittings	Coaxial type

OPERATION: Insert the line cord into any 117 volt, AC, 60 cycle outlet and rotate the Selector switch to any position other than PWR OFF. This will automatically turn on the instrument. Always allow a "warm-up" period of at least a half hour before accurate measurements are made. This allows the instrument to properly stabilize.

CONTROLS:

There are four controls on the Model 610 and two Amphenol type connectors.

OUTPUT JACK - All output signals, RF and AF, are available from this jack. It is so designed as to have a series "DC Blocking Condenser" and may be used, therefore, in circuits containing DC Voltages. Do not connect into circuits using more than 350 volts DC.

EXT. MOD. JACK - External AF signals may be fed into this terminal. They will be amplified through the internal speech amplifier of the 610 and, when the Selector switch is rotated to the EXT. MOD. position, will modulate the RF. In essence this position turns the Model 610 into a small voice transmitter.

RF BAND - This control selects the particular frequency range desired. As an example - 2.5 megacycles would be found on the 1-3MC position.

SELECTOR - This switch selects the function to be performed.

Position 1- This turns off the power to the instrument.

Position 2- An RF signal modulated at 400 cycles is available at the output.

Position 3- This position is similar to that of position 2 except that the modulating frequency is 60 cycles instead of 400.

Position 4- This position serves a dual purpose. Without a signal fed into the EXT. MOD. jack, pure RF is available at the OUTPUT. When an AF signal is connected to the EXT. MOD. jack, the OUTPUT is modulated in accordance with the A.F.

Position 5- In this position a pure 400 cycle signal is fed out through the OUTPUT jack. The RF section of the instrument is placed in a STANDBY position.

OUTPUT POTENTIOMETER - This control attenuates all output signals.
MAIN TUNING - The main tuning knob rotates the RF Scale. It is mechanically connected, in a planetary arrangement, with the two-gang variable condenser. The first five scales, reading from the top to the bottom, correspond with the five ranges of the RF BAND switch. The last scale, from 90MC through 330MC, is calibrated as the third harmonic of the fifth scale.

ALIGNMENT OF THE SUPERHETERODYNE RECEIVER

General:- One of the basic rules in any alignment is first to check the manufacturer's specifications as far as frequencies to be used and the actual procedure recommended. Since each transformer or coil in a particular set was selected according to its response characteristic, the manufacturing procedure sets the frequency of each coil so that the overall operation of the set is proper. This is especially true in stagger-tuned receivers of all types(including of course, FM and TV).

I.F. ALIGNMENT:- One of the most commonly used methods of I.F. alignment consists of the following:

a) Connect a VTVM or other indicating device to the AVC circuit of the receiver.
b) Disable the Oscillator of the receiver in some way such as shorting the oscillator grid, etc.
c) Connect the output of the Model 610 to the Converter grid of the receiver.
d) Set the RF scale of the 610 to the IF frequency of the receiver- this is usually about 456KC or thereabouts.
e) Adjust each of the I.F. transformers for a peak negative reading in the AVC circuit. Use as low an output as possible. If a stagger tuned arrangment is used, proceed as above except that the 610 frequency is adjusted to the suggested frequency by the manufacturer Each transformer is then individually peaked at its particular frequency.

If the transformers are so far off frequency that a signal cannot be forced through the receiver, it may be necessary to feed the 610 output to the grid of the last IF and then gradually work forward until the signal can be fed into the converter grid. If the latter were necessary, it is suggested that the various transformers be readjusted when the 610 is connected to the Converter Grid.

OSCILLATOR ALIGNMENT:

a) Connect the output of the Model 610 to the antenna terminals of the receiver. Use as weak a signal as possible. Remove the oscillator short bringing it back to normal.
b) Leave the VTVM connected to the AVC as described above.
c) Set the receiver to the highest frequency on its scale.
d) Set the Model 610 to the same frequency as in the preceeding step.
e) Adjust the receiver oscillator trimmer for the maximum reading on the VTVM.
f) Set the receiver to the lowest frequency on its scale.
g) Adjust the receiver oscillator padder or slug, if provided with the same, for maximum reading on the VTVM.
h) Repeat steps (c) - (g) until no further adjustment is required.

R.F. ALIGNMENT:

Connect the output of the Model 610 to the antenna terminals of the receiver through a very small capacitor. Repeat steps (b) thru (h) described in the Oscillator Alignment except that the RF trimmers and padders (if any) will be adjusted. Once this set is almost aligned, the very small capacitor may be simulated by clipping the alligator clip output of the 610 to an insulated portion of the antenna wire. This prevents the RF input section of the receiver from being thrown slightly off adjustment as might be caused in certain receivers by physically making contact directly.

FM & TELEVISION ALIGNMENT:

The previously suggested method of Superheterodyne receiver alignment is readily applicable to FM and television receiver alignment, but, since it is practically mandatory that the manufacturer's procedure be used, it is not listed herein.

MARKER GENERATOR:

Using the Model 610 as a marker generator simply consists of feeding its output to the input of the device being tested along with that of a Sweep Generator. The 610 should be used in the CW position for this application. The output of the 610 should be kept to as low a level as possible or until the "pip" is just visible. This prevents "swamping" of the pattern.

TROUBLE SHOOTING BY SIGNAL INSERTION:

General:- Most trouble shooting actually consists of isolating the difficulty. Various methods may be used, but they all have the same general principle: Isolate the section; Isolate the stage; Isolate the part.

Trouble shooting by signal insertion in a superheterodyne would follow the procedure listed below:-

1- The Model 610 is set to the AF-400 cycle position with the output fed to the grid of the last AF amplifier of the receiver. If the signal is heard through the loudspeaker it is assumed that all sections following that stage are correct. If the signal is not heard, the section is checked.

2- While at the same setting, the output of the 610 is then fed into the grid of the first AF amplifier. The output signal is again checked as mentioned, but this time a noticeable gain should be seen.

3- The 610 is then switched to the AM-400 cycle position and set to the IF frequency of the receiver. The signal is then inserted into the grid of the last IF amplifier.

4- While at the same setting as in step 3, the signal is progressively moved up to the grid of the converter tube.

5- Finally the 610 and the receiver are both adjusted to some RF frequency and the 610 connected to the antenna of the receiver.

6- If the signal should become considerably attenuated or completely lost in progressing from one step to another, it may be assumed that the trouble is between the stage which passed the signal and the one which did not. A conventional VTVM is then brought into use for ascertaining the exact nature of the trouble at this point. Note: a loss of signal may be noticed when changing from one mode of operation to another: i.e. Changing from AF to RF or going from the IFs to the converter grid. This is considered normal.

TROUBLE SHOOTING BY SIGNAL TRACING:

Signal tracing may be considered to be the reverse of signal insertion. This method consists of feeding the signal into the antenna of the receiver and progressively tracing the signal through the receiver with some type of indicating device. The procedure would be as follows:

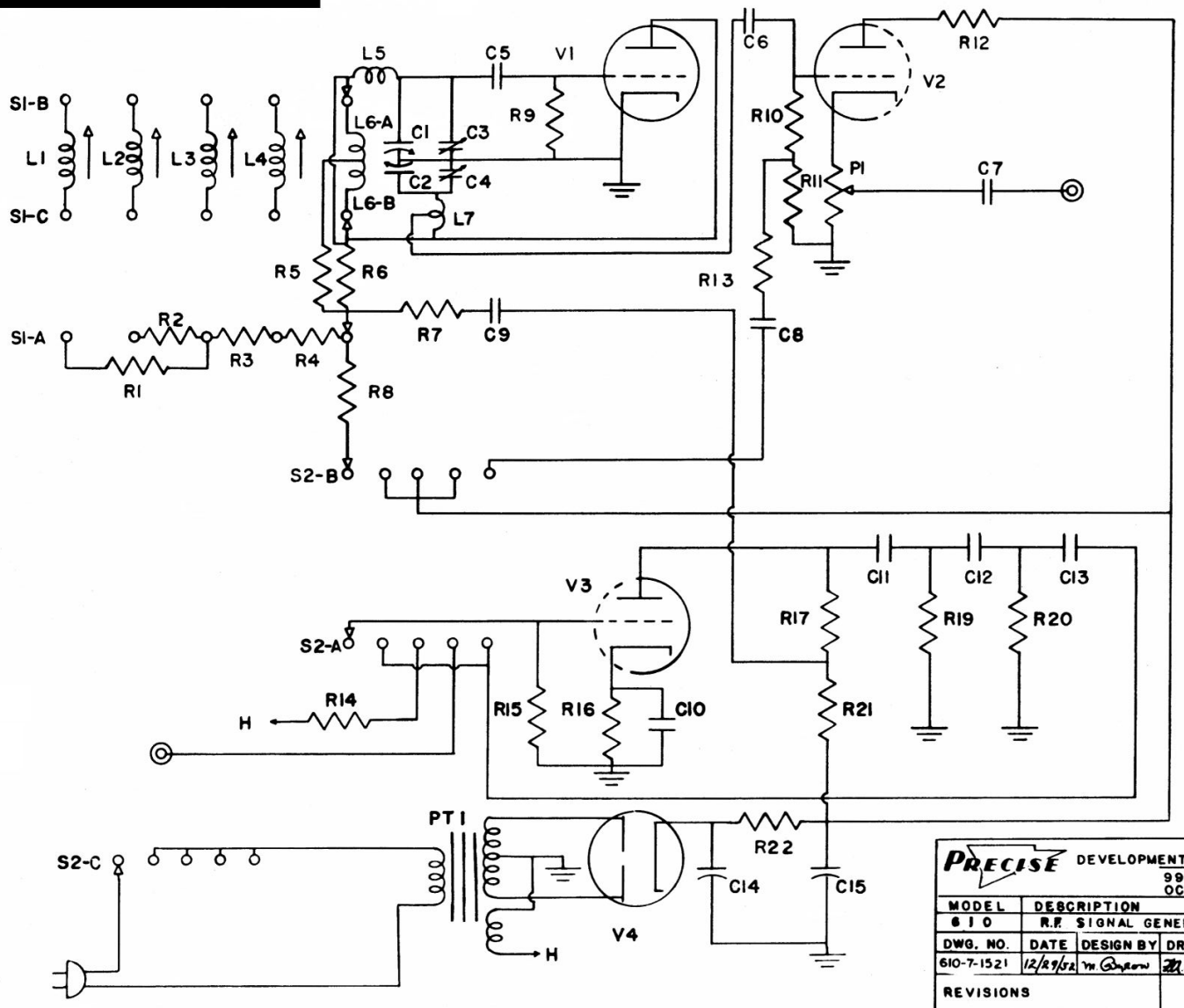
1- Feed an RF signal into the antenna terminals of the receiver.

2- Using an RF probe, such as PRECISE Model 912, check the signal through each of the IF stages.

3- The AF section may be checked with an Oscilloscope or AC meter

4- The section is isolated as being the stage between which the signal was noticed and the one where no signal appeared.

SCHEMATIC



PRECISE DEVELOPMENT CORP. 999 LONG BEACH ROAD OCEANSIDE, NEW YORK				
MODEL	DESCRIPTION			
610	R.F. SIGNAL GENERATOR			
DWG. NO.	DATE	DESIGN BY	DRAWN BY	CHECKED BY
610-7-1521	12/29/52	M Brown	M Rollings	A.P.S.
REVISIONS				

DESCRIPTION	PART#
Variable Condenser	C1-4
300 uufd "	C5
.1 ufd "	C7
.01 ufd "	C8
.1 ufd "	C9
.25 ufd "	C10
100 uufd "	C11
" " "	C12
" " "	C13
20x20 ufd Condenser	C14&15
White Dot Coil	L1
Yellow " "	L2
Red " "	L3
Black " "	L4
HF Coil	L5
Buss Bar in Spaghetti	L7
2,000 ohm Potentiometer	P1
Power Transformer	PT1
220K Resistor	R1
47K "	R2
33K "	R3
10K "	R4
820 "	R5
22K "	R6
1K "	R7
3.3K " 1 Watt	R8
330K Resistor	R9
470K "	R10
47K "	R11
22K "	R12
470K "	R13
3.9M "	R14
1.2M "	R15
1.5K "	R16
47K "	R17
1.5M "	R19
" "	R20
22K "	R21
3.3K " 1 Watt	R22
5 Position Switch(long)	S1
" " " (short)	S2
6C4	V1
12AX7	V2-3
6X5	V4

CALIBRATION

You have now completed the construction and wiring of your MODEL 610. A few more points of CAUTION here may save the waiting time for replacement parts.

1. Check over the entire assembly. Make certain that all connections are properly soldered; that rosin has not caused leakage between pin or switch contacts; that there are no rosin joints. Do this in an organized way, starting from one end of chassis and gradually progressing to the other side while examining all connections.

2. Check the resistance from pin 8 of the 6X5 to ground. This should be at least 30,000 ohms and the ohm-meter needle should show the gradual charging of the electrolytic condensers. If a lower resistance is observed, DO NOT TURN SET ON, but recheck the power supply wiring.

3. Plug the line cord into any 110 volt 50-60 cycle line. Turn power on by rotating the SELECTOR switch to any pos. other than PWR OFF. The pilot light should light immediately. If it does not, turn power off AT ONCE and recheck filament wiring.

SPECIAL SCALE: It is often said that "an instrument is as accurate as its scales". The aforementioned has been proved true many times with some of the most expensive instruments coming out with hand drawn scales. This follows since it is veritably impossible to make a multi-range instrument calibrate easily on just one scale. The above problem was the one given to the PRECISE DEV. ENGINEERING DEPT. with special emphasis placed on finding a method of approaching the accuracy of "hand drawing" without the obvious tremendous disadvantage in cost. Basically it was treated as an engineering problem with the following facts noted:

1. An instrument which was "off-calibration" most often retained the proper distribution curve. i.e. although the reading was wrong, the scale was off in the same direction on each portion of the band.
2. If the range could be moved, most of the scale could be brought within a prescribed tolerance.

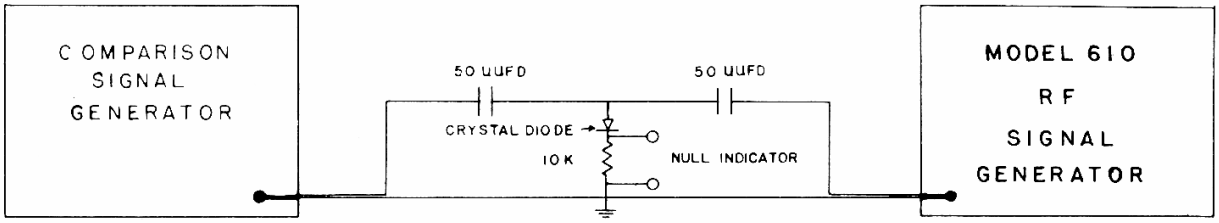
The result of these observations is in the enclosed scale. You will note that each scale range on each scale is slitted with the exception of one. If desired any one of the ranges may be removed by completing the cut along its left and right edge with a razor. The scale may then be reinserted and moved slightly in the proper direction to compensate for the error noted. Since this will cause a slight over-lapping at one edge, it must then be trimmed. Note: we do not recommend the cutting of scales until several months of use have allowed components to age properly. Once final calibration has been made, after several months of aging, a cement such as Duco may be used to secure the scale permanently to the drum. The tape which previously held the scale may then be removed.

RF CALIBRATION: The following calibration procedure refers only to the Model 610K and may be omitted by those who have the Model 610KA (Pre-calibrated RF Head).
There are two generally accepted procedures in the calibration of signal generators: 1. Calibration against another signal generator; 2. Calibration against radio stations by using a communications receiver, radio or FM receiver as a detector. Both methods are explained herein. The 2nd method is considered to be a more exact check since the frequencies are extremely accurate.

STABILIZATION: Allow the instrument at least an hour's "warm-up" before calibration. This allows the components to stabilize.

CALIBRATION AGAINST ANOTHER SIGNAL GENERATOR (SIGNAL COMPARISON)
The signal comparison method of calibration consists of feeding two signals (one unknown and one known) into a detector (a device for beating or heterodyning two or more signals) and adjusting for a Zero-beat.

1. Wire the circuit shown in the figure below. The Null Indicator could be a pair of earphones, a VTVM, an Oscilloscope, an Audio Amplifier or a Multimeter. On the VTVM or Multimeter, a zero-beat can be observed if the AC range is used. If desired a crystal probe similar to the PRECISE Model 912MM, could be used as the entire circuit with both signal generators feeding into the tip. The probe could then be terminated in any of the aforementioned Null Indicators.



2. Use the following calibration chart for aligning the bands. Explanation on using the following chart: The first line states: "The frequency to which the first band is tuned is 300KC (300,000 cycles). The Comparison Signal Generator is to be tuned to 300KC. The Model 610 is to be tuned to 300KC and its dial to be set for that frequency on the .3M-1MC range of the RF BAND switch. The slug on the White Dot Coil (L1) is to be adjusted for "Zero-beat" on the Null Indicator".

CALIBRATION CHART: Set all controls as follows and then proceed through steps 1 thru 6 for Final Calibration. Set RF Band to settings as listed in Chart; Rotate the Function SELECTOR switch to CW; OUTPUT POTENTIOMETER to maximum clockwise; RADIO FREQUENCIES to Frequency on chart; other controls are not used. Set Comparison Generator to Frequencies below using CW position. All adjustments are made for Zero-beat.

STEP	CALIBRATING FREQUENCY	SET COMPARISON GENERATOR TO	SET 610 TO	SET 610 ON BAND	ADJUST
1	300KC	300KC	300KC	.3-1MC	Slug on L1 (White Dot
2	1MC	1MC	1MC	"	Trimmers on C1 & C2
3	"	"	"	1-3MC	Slug on L2 (Yellow)
4	3MC	3MC	3MC	3-10MC	Slug on L3 (Red)
5	30MC	30MC	30MC	30-100MC	Coil L5 (HF)
6	10MC	10MC	10MC	10-30MC	Slug on L4 (Black)

Notes referring to above steps:
Step 2: On occasion it may be necessary to open the trimmers on C1 & C3 all the way out.
Step 5: If the frequency is lower than 30MC, place an insulated alignment tool between turns of L5 and gently twist the alignment tool (thereby spreading the turns) until Zero-beat is heard. If when alignment tool is withdrawn the Zero-beat is lost, move the turns a trifle apart to compensate for the spring tension of the coil. Removal of the alignment tool should then bring the frequency to its proper setting. The reverse is true if the frequency were too high.
Note: It is imperative that an insulated tool be used here since B+ is present on the coil and also since a metal tool would change the electrical characteristics. We do not recommend the use of a slug for this coil since losses may occur especially on the high frequency end of the band.

CALIBRATION WITH A COMMUNICATIONS RECEIVER:
This procedure consists of beating the Model 610 with a known frequency station and then by harmonics, calibrating the remainder of the ranges.

CALIBRATION CHART: Set all controls as follows and then proceed thru Steps 1 thru 7 for final calibration. RF BAND to setting as listed in chart; SELECTOR SWITCH to CW; OUTPUT to maximum clockwise; RADIO FREQUENCIES to frequency on chart. Other controls are not used. Connect the output on the Model 610 thru a small condenser (about 100uufd) to the antenna terminal of the receiver. Explanation on using the following table: The first line states: "The receiver is to be tuned to a station around 600KC or slightly above". The Model 610 is to be set to a frequency which is exactly $\frac{1}{2}$ the frequency on the .3-1MC range. The slug on L1 (white dot coil) is then adjusted until a Zero-beat is heard. Adjust Steps 1,2 & 3 for a Zero-beat and Steps 5,6 & 7 for change in background level.

STEP	TUNE RECEIVER TO	SET MODEL 610 TO	SET MODEL 610 ON BAND	ADJUST
1	Station around 600KC or over	Exactly $\frac{1}{2}$ frequency of station	.3-1MC	Slug on L1 (white)
2	Station around 1MC or slightly lower	Same frequency as station	"	Trimmers on C1 & C2 See note below
3	Station around 1.2MC or slightly higher	"	1-3MC	Slug on L2 (yellow)
4	Although certain stations of known frequency do exist above the broadcast range in certain localities, they are extremely difficult to receive. We therefore show the harmonic method which follows. (Note: If your area can receive stations of known frequency of above broadcast range, you may follow the above procedure of Step 3 for the remaining low frequency adjustment of the three remaining bands. The Red Dot Coil is adjusted for 3MC or slightly higher; the Black Dot Coil is adjusted for 10MC or slightly higher and the HF Coil (L5) is adjusted for 30MC.)				
5	3 times frequency of Step 3 until change in noise is apparent. If Receiver is slightly off, its Dial may not coincide exactly	3 times frequency of Step 3 above	3-10MC	Slug on L3 (red) See note below
6	3 times frequency of Step 5 until change in background noise is apparent	Exactly 3 times frequency of Step 5 above	10-30MC	Slug on L4 (black) This about 10.8MC
7	3 times frequency of Step 6 above	Exactly 3 times frequency of above	30-100MC	L5

Step 2: Adjust both trimmers approximately the same. If necessary, all the way out.
Step 5: The receiver and generator are both tuned to the same frequency of about 3.6MC, when this step is completed. It is important that the proper order be followed with the receiver being tuned first as read from left to right.

DIAGRAM 7 | **RF CHASSIS** | **REAR VIEW**