CIRCUIT DESCRIPTION

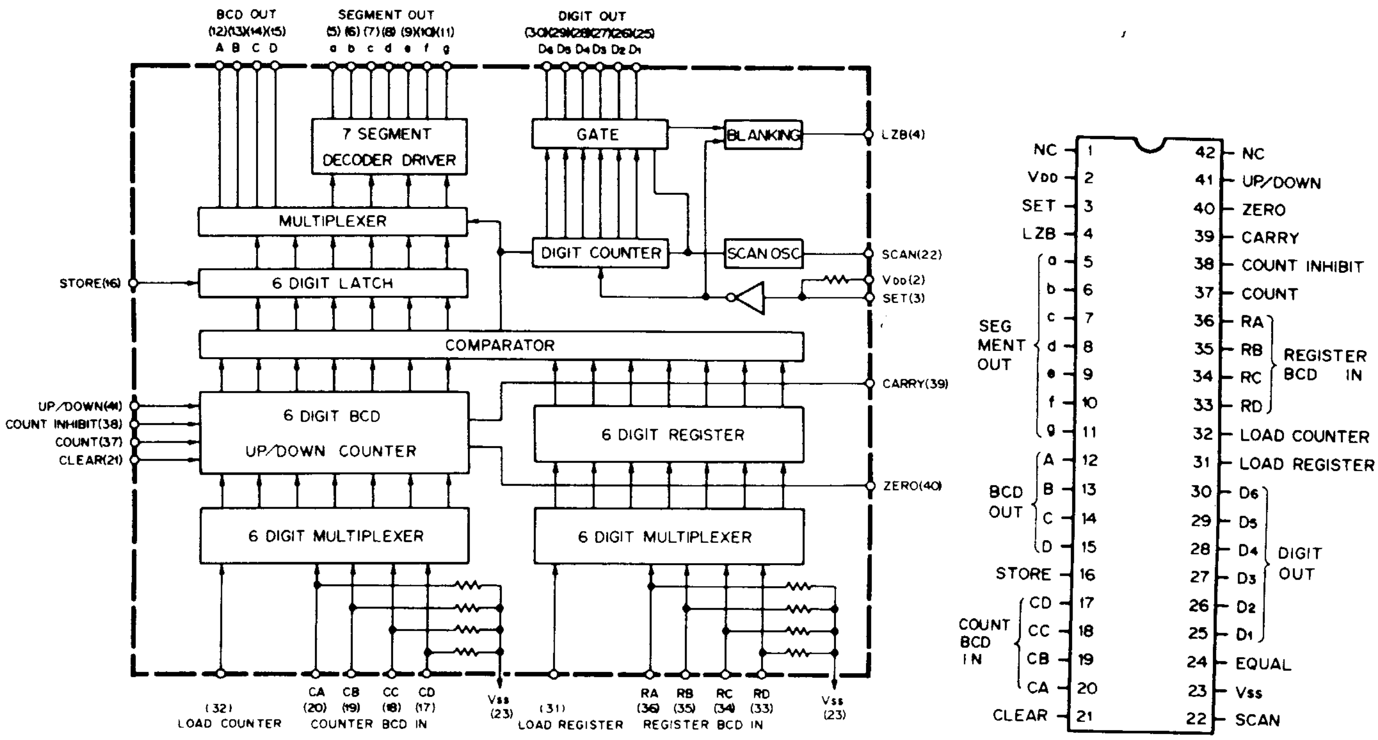


Fig. 4 TC5070P (Counter unit, Q5)

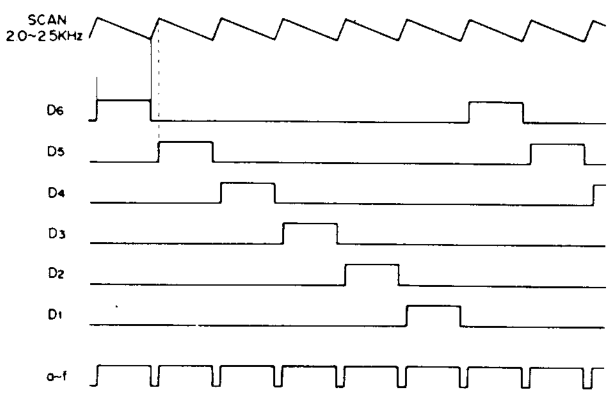
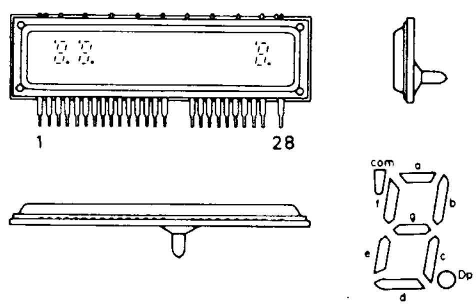


Fig. 5 TC5070P timing chart



PIN NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CONNECTION	F	N_C	G_9	N_C	N_C	G_8	g	f	G_7	e	d	G_6	N_C	N_C
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	G_5	N_P	N_P	G_4	D_P	G_3	c	b	G_2	a	COM	G_1	N_P	F

Fig. 6 Indicating tube 9-BT-12

Q5 (TC5070P) is a presettable, 6-digit BCD counter which incorporates a 6-digit latch, 6-digit dynamic drive digital counter, and 7-segment decoder/driver. Band information supplied from the RF unit is applied to a diode matrix to preset the 100 kHz, 1 MHz, and 10 MHz digits. Preset values are given in Figure 3. For instance to preset 14.000 MHz, with a 500 kHz counter input signal, 10 MHz value is preset to 1, 1 MHz to 3, and 100 kHz to 5, the 500 kHz counter input signal subtracted from 14.000 MHz (If no counter input signal were present, 13.500 MHz would be displayed.) Q5 supplies the display tube drivers with 7-segment information and dynamic drive control signals to light the fluorescent display tube.

In the counter unit, a diode matrix generates frequency division information and supplies the PLL unit with this information. If the PLL unlocks, a BLK (Blanking Low) signal will be applied to the digit drive IC (Q11) to blank the fluorescent display tube. Normally, five high-order digits are displayed. DH (digital hold) locks the display from changing. Digital hold is accomplished by presetting the latch pulse at Low level.

CAR OSCILLATOR

The CAR oscillator is composed of an oscillator and two quarts crystals. The output frequency in each mode is given in Figure 1. During reception, this frequency can be varied by the IF shift.

VFO

The output frequency is 5.5~6.0 MHz. During CW transmission, the frequency will be shifted 800 Hz higher than the reception frequency. Therefore, real operating frequencies will always be displayed.

CIRCUIT FEATURES

1. Optional filters available

The TS-830S is equipped with 2.7 kHz filters in both the 8.83 MHz and 455 kHz IF's. Narrow filters are separately available for both 8.83 MHz and 455 kHz.

IF jumper pins	8.83 MHz filter	455 kHz filter
CW1 CW2 CW3 CW4	STD (YK88S1) OP (option) STD (YK-88S1) OP (option)	STD (CFJ455K5) STD (CFJ455K5) OP (option) OP (option)
6 dB bandwidth	YK-88S1 = 2.7kHz OP (YK-88C) = 500Hz OP (YK-88CN) = 270Hz	CFJ455K5 = 2.7kHz OP (YG-455C) = 500Hz OP (YG-455CN) = 250Hz

Table 7. STD and OP filter combinations

Item	Rating
Center frequency *fo*	8830.7 kHz
Center frequency deviation	*fo* ±150Hz at 6 dB
6 dB bandwidth	±250 Hz or more
60 dB bandwidth	±900 Hz or less
Ripple	2 dB or less
Loss	6 dB ± 2 dB
Guaranteed attenuation	80 dB or more within *fo* ±2 kHz to ±1 MHz
Input and output impedance	600Ω // 15 pF

Table 8. CW Crystal filter (L71-0211-05) YK-88C (Option)

Item	Rating
Center frequency *fo*	8830.7 kHz
Center frequency deviation	*fo* ± 50 Hz at 6 dB
6 dB bandwidth	±125 Hz or more
60 dB bandwidth	± 600 Hz or less
Ripple	2 dB or less
Loss	8 dB ± 2 dB
Guaranteed attenuation	80 dB or more within *fo* ±2 kHz to ±1 MHz
Input and output impedance	600Ω// 15 pF

Table 9. CW Crystal filter (L71-0221-05) YK-88CN (Option)

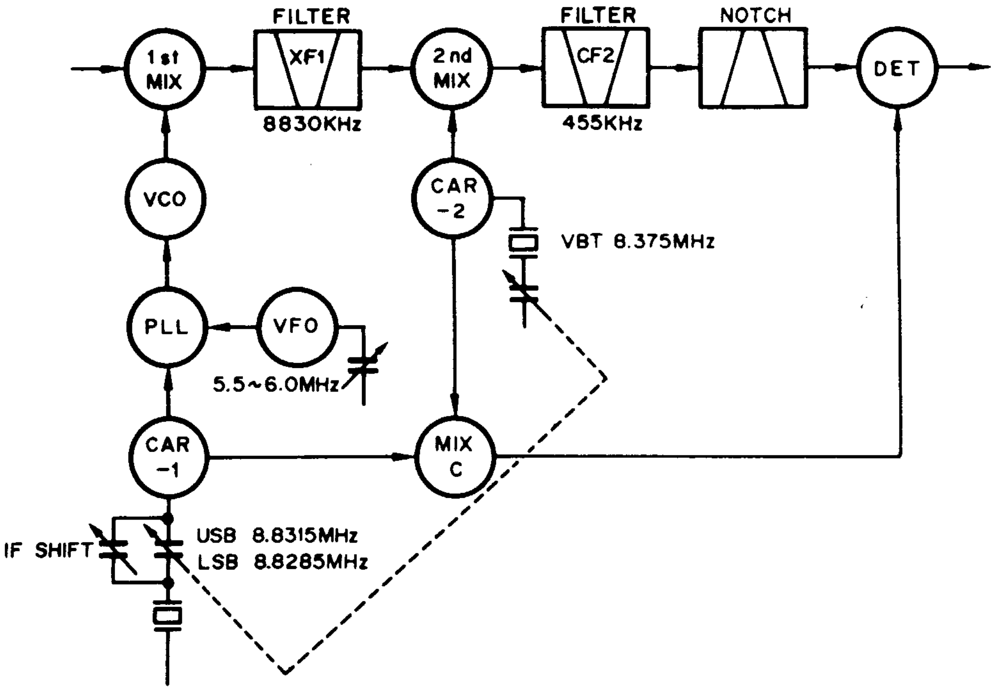
Item	Rating
Center frequency *fo*	455.7 kHz
Center frequency deviation	*fo* ±50 Hz at 6 dB
6 dB bandwidth	±250 Hz or more
60 dB bandwidth	±425 Hz or less
Ripple	2 dB or less
Loss	6 dB or less
Guaranteed attenuation	80 dB or more at 100 Hz to 455.1 kHz and 456.3 kHz to 2 MHz
Imput and output impedance	2 kΩ// 15 pF

Table 10. CW Crystal filter (L71-0206-05) YG-455C (Option)

Item	Rating
Center frequency *fo*	455.7 kHz
Center frequency deviation	*fo* ±50 Hz at 6 dB
6 dB bandwidth	±125 Hz or more
60 dB bandwidth	±250 Hz or less
Ripple	2 dB or less
Loss	6dB or less
Guaranteed attenuation	80 dB or more at 100 Hz to 455.3 kHz and 456.1 kHz to 2 MHz
Input and output impedance	2 kΩ// 15 pF

Table 11. CW Crystal filter (L71-0207-05) YG-455CN

CIRCUIT DESCRIPTION



BAND	VCO MHz
1.5	10.33~10.83
3.5	12.33~12.83
7	15.83~16.33
10	18.83~19.33
14	22.83~23.33
18	26.83~27.33
21	29.83~30.33
24.5	33.33~33.83
28	36.83~37.33
28.5	37.33~37.83
29	37.83~38.33
29.5	38.33~38.83

Fig. 7 Frequency configuration

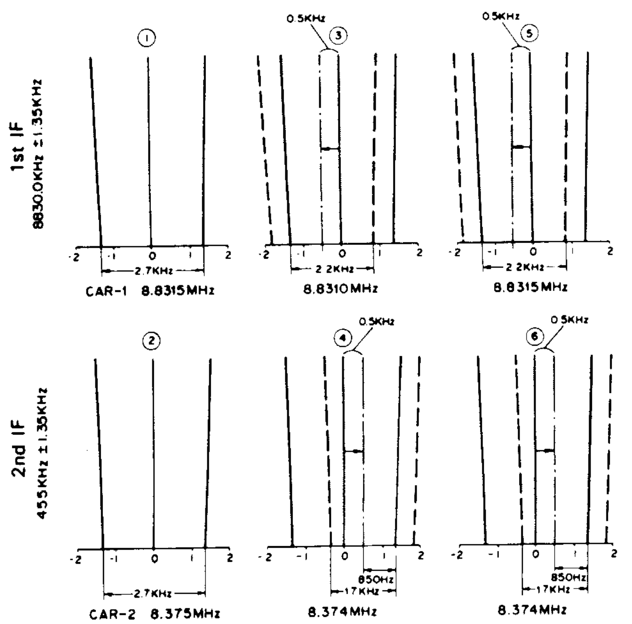


Fig. 8 VBT.IF SHIFT

2. VBT and IF SHIFT

VBT (variable bandwidth tuning) allows varying the bandwidth, operation of which is determined by the 8.83 MHz and 455 kHz filters and by changing the output frequencies of CAR-1 and CAR-2 simultaneously with the VBT control. Frequency organization of the VBT and IF SHIFT is shown in Figure 7. Assuming that a signal centered at 14.0015 MHz is received without IF shift or VBT, the VFO output frequency is 5.5015 MHz, CAR-1 8831.5 kHz, and the VCO output applied to the first mixer is 22.8315 MHz.

The mixer converts this to a signal whose center frequency is 8.830 MHz (22.8315 MHz − 14.0015 MHz = 8.830 MHz). The signal frequency is then converted to 455 mHz by the second mixer. To help understand VBT operation, assume the composite bandwidth determined by filters XF1 and CF2 is 2.7 kHz in the normal (unshifted) state of CAR-1 and -2. Frequency organization to obtain a specific bandwidth and IF SHIFT is described below.

Example 1 (no IF shift)

(Bandwidth: 1.7 kHz
IF SHIFT: 0 kHz)

When the CAR-2 frequency is reduced by 1 kHz using the VBT control and a signal centered at 14.0015 MHz is received, the CAR-1 and -2 frequencies are as follows.

CAR-1 8831.0 kHz (= 8831.5 kHz − 0.5 kHz*)
CAR-2 8374.0 kHz (VBT control)

* The system is designed so that only half the amount of frequency shift applied to CAR-2 is applied to CAR-1.

Assume the received signal has a frequency spectrum extending over 14.0015 MHz ± 1.35 kHz. Since CAR-1 output is 8831.0 kHz, the VCO output frequency is 22.8310 MHz and, therefore, the frequency of the first IF signal is 8829.5 kHz ± 1.35 kHz due to a shift of −500 Hz (22831.0 kHz − 14001.5 kHz = 8829.5 kHz). Since the frequency characteristic of the first IF filter is 8.830 MHz ± 1.35 kHz as noted above, frequency components are cut in the lower side band by 500 Hz more than in the normal state, as illustrated in Fig. 8 (3). The second intermediate frequency generated in the second mixer is 455.5 kHz ± 1.35 kHz.

(8829.5 kHz (No. 1 IF) − 8374.0 kHz (CAR-2) = 455.5 kHz)
Thus the second IF signal is shifted by +500 Hz, and as a result the upper-side frequency components are cut by 500 Hz, as illustrated in (4). The frequency spectrum of the signal which has passed the second IF stage is 455.5 kHz±850 Hz and the bandwidth is 1.7 kHz. If we convert the signal frequency to an equivalent one at the ANT input, we obtain 14.0015 MHz±850 Hz. In this case IF SHIFT operation is not performed.

Example 2

(Bandwidth: 1.7 kHz
IF SHIFT: 500 Hz (positive shift))

When the frequency of CAR-2 is lowered by 1 kHz with the VBT control and that of CAR-1 raised by 500 Hz with the SHIFT control, the resulting frequencies of CAR-2 and -1 are:

CAR-1 8831.5 kHz (= 8831.5 kHz − 0.5 kHz*1 + 0.5 kHz*2)
CAR-2 8374.0 kHz

*1 Half the amount of frequency varied by VBT
*2 The amount of frequency rise with IF SHIFT

Let us examine the frequency spectrum of the ANT input signal from the second IF component in Example 1.
You will recall that the center frequency of the second IF signal component is 455.5 kHz and the upper limit 455.5 kHz + 850 Hz.
The signal is 455.5 kHz + 8374.0 kHz = 8829.5 kHz in the first IF and the lower limit 8829.5 kHz − 850 Hz. As a result, signal components which have passed an 8830 kHz filter and a 455 kHz filter are the same as in Example 1. But the VCO output is 22.8315 MHz because CAR-1 which was 8831.0 kHz in Example 1 is 8831.5 kHz in Example 2. Since the converted equivalent frequency range at the first IF is 8829.5 kHz±850 Hz, its equivalent at the ANT input is 14.002 MHz±850 Hz.
(22.8315 MHz − 8.8295 MHz = 14.002 MHz)
This means that a signal 1.7 kHz in bandwidth is received with a shift of +500 Hz. In other words, the filter characteristics have been changed appropriately.
As you may have noted in Examples 1 and 2, the VBT and IF SHIFT controls operate separately. Therefore, it is possible to control the bandwidth alone while keeping the IF SHIFT unchanged, or control IF SHIFT while keeping the bandwidth unchanged.

3. NOTCH [in IF unit (X48-1290-00)]

This is a bridged-T filter consisting of L, C, and R components. The notch is provided in the 455 kHz IF. Normally, the width of the null would be broad at 455 kHz. Actually a sharp notch is provided by adding an active circuit which applies positive feedback to raise the Q. Q5 and Q6 (2SC1815Y) are a Q-multiplier. Q7 (2SC1815Y) is a buffer amplifier.

4. Speech processor [in IF unit (X48-1290-00)]

This speech processor is an RF clipper. The receiver uses two intermediate frequencies and two filters for VBT. In the transmitter, an SSB signal is generated at 455 kHz, is converted to 8830 kHz, and passed through an SSB 8.83 MHz filter after frequency conversion. This configuration is convenient for installing RF clippers between the stages. The 455 kHz SSB signal is clipped and then converted to an 8.83 MHz signal, and then routed through an 8.83 MHz SSB filter to remove splatter components generated during clipping. Q24 (2SC1815Y) is a processor amplifier, Q26 (TA7302P) a limiting amplifier, Q27 (3SK73GR) a control amplifier, and Q25 (2SC1815Y) and Q37 (2SA1015Y) compose a compression meter amplifier. The compression meter reads the mean compression level.

5. Final-stage RF NFB

Negative feedback is applied to the driver from the final output stage via C6, a 3PF, 3KV capacitor to reduce intermodulation distortion.

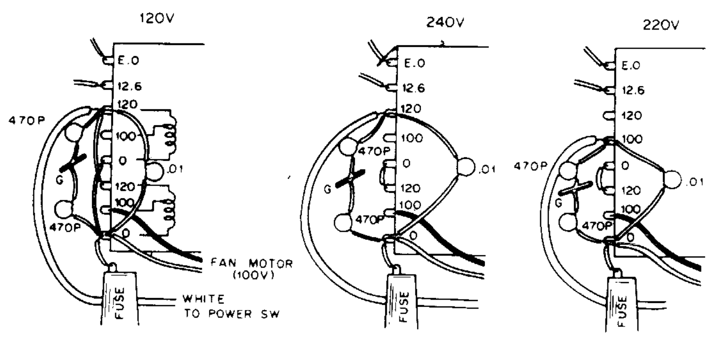
6. RIT/XIT Operations

In addition to the conventional RIT, the transmission frequency can be varied with the XIT control.

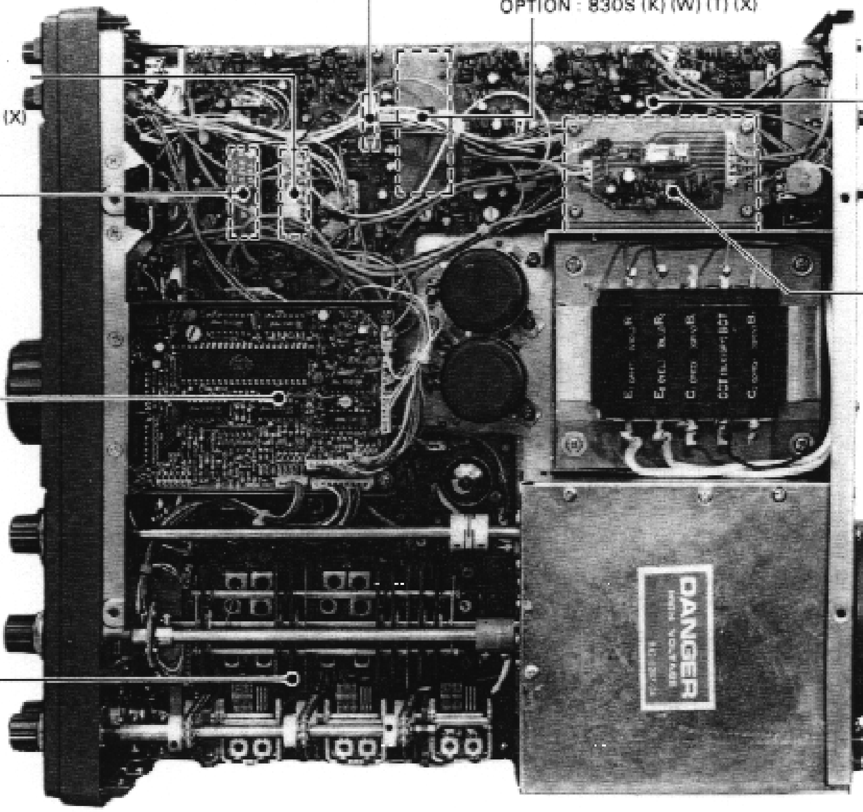
TS-830S (K) AC Voltage conversion

To operate the TS-830S (K) on 240V AC, the power transformer split primaries must be rewired from parallel to series connection.

1. Unplug the AC power cable.
2. Remove the bottom cover.
3. Remove the jumper wires between the two ϕ terminals and two 120 terminals on the bottom of the power transformer.
4. Connect the adjacent 120 and ϕ terminals at the middle of the transformer. This will provide 240V AC operation. For 220V AC operation, change the wires from 120 to 100 winding.
5. Change the AC fuse from 6A to 4A. Tag the power cord at the back of the radio to indicate that the transformer is strapped for 240V AC, and the power fuse should be 4A, and not 6A.
6. Replace the bottom cover and reconnect power to verify your work.



INSIDE VIEWS



[830M type is shown.]