# INSTRUCTION MANUAL FRG-7000

YAESU MUSEN CO., LTD.

TOKYO JAPAN.

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"WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE."

### **COMMUNICATIONS RECEIVER FRG-7000**



### GENERAL DESCRIPTION

The model FRG-7000 is a high-performance, all solid state, communications receiver designed to cover the entire medium and high-frequency spectrum from 0.25 MHz - 29.9 MHz.

The FRG-7000 features a digital frequency display using large, bright digits for easy viewing. Also included is a 24-hour digital clock for both local and GMT time, with a timing feature for automatic receiver on/off switching.

The FRG-7000 is a triple-conversion superheterodyne receiver, utilizing a synthesized heterodyne oscillator known as the "Wadley Loop System," offering extremely stable receiver performance.

The IF filtering in the FRG-7000 provides a bandwidth of 3 kHz for SSB and CW (at 6 dB down), and 6 kHz for AM (at 6 dB down), thus providing superb rejection of unwanted interference.

The FRG-7000's switchable front-end attenuator and amplified AGC assist in reception under a

variety of conditions, and the continuously variable audio filter provides for minimizing the high or low frequency audio response, as needed. A front panel recording jack plus relay connection jacks on the rear panel provide the flexibility demanded by the discriminating listener.

Plug-in circuit boards are used in the FRG-7000, providing high reliability and ease of servicing. FET's and IC's are used throughout the receiver, providing maximum performance within a compact cabinet.

A built-in AC power supply allows operation from 100/110/117/200/220/234 volts AC, 50/60 Hz. To reduce power consumption, the front panel lamps and digital display may be turned off.

The FRG-7000 is a precision-built instrument. Its performance, versatility, and reliability assure the discriminating listener of many hours of satisfying reception.

### **SPECIFICATIONS**

Frequency Range:

0.25 MHz - 29.9 MHz

Type of Emissions:

AM, SSB (USB or LSB), CW

Sensitivity:

AM:

SSB/CW: Better than  $0.7\mu V$  at S/N 10 dB

Better than 2µV at S/N 10 dB

Selectivity:

 $SSB/CW \pm 1.5 \text{ kHz} (-6 \text{ dB}), \pm 4 \text{ kHz} (-50 \text{ dB})$  $AM \pm 3 \text{ kHz} (-6 \text{ dB}), \pm 7 \text{ kHz} (-50 \text{ dB})$ 

Stability:

Less than ±500 Hz at any 30 minutes after

warm-up

Antenna Requirements:

μPD546C-1(CPU) 1

Random wire 0.25 MHz - 1.6 MHz 50 Ohm unbalanced feed 1.6 MHz - 29.9 MHz Speaker Impedance:

4 ohms

Audio Output:

2 watts

Power Requirement:

100/110/117/200/220/234 volts

AC 50/60 Hz

**Power Consumption:** 

AC 25 VA

Size:

360 (W), 125 (H), 295 (D) mm

Weight:

Approx. 7 kg

### SEMICONDUCTOR COMPLEMENT

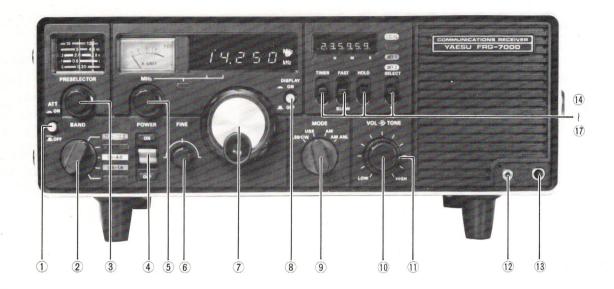
IC	SN76514N	2		μPC14305	1
	TA7205AP	1		μPC14308	2
	MC1416	2		NJM78L05A	1
	MC14011	1	FET	3SK40M	7
	MC14016	1		2SK19GR	8
	MC14027	1	Tr.	2SC372Y	8
	MC14081	1		2SC373	4
	MC14518B	1		2SC535A	1
	MC14519B	1		2SC784(O)	1
	MSM5502	1		2SC828	1
	MSM5592	1		MPS-A13	2
	SN7407N	2	Ge Diode	1S1007	11
	SN74LS00N	2	Si Diode	1S1555	17
	SN74LS90N	1		V06B	8
	SN74LS112N	1	LED	SL-103D	2
	SN74LS390N	1	LED Display	5082-7286	1
	SP8646B	1		5082-7740	5
	μPA56C	1			

### **ACCESSORIES**

The following accessories are packaged along with your FRG-7000:

- (1) MINIATURE PHONE PLUG 2 ea. For use in EXT SP or REC jacks.
- (2) PHONE PLUG 1ea. For use with headphones.
- 2 ea. (3) RCA TYPE PLUGS For use in control of station equipment through relay jacks on rear panel.
- (4) UHF COAX PLUG 1 ea. For connection to HF antenna using coaxial feedline.
- 2 ea. (5) EXTRA FUSES 3 amp fuse plus another 1 amp or 0.5 amp fuse, depending on local supply voltage.
- (6) WIRES 3M/10M 1 ea. For indoor antennas.

### CONTROLS AND SWITCHES



The FRG-7000 has been specifically designed for ease of operation. All controls have been adjusted at the factory to ensure peak performance. The operator may be unfamiliar with the operation of some of the controls, and improper settings thereof may result in poor reception. For this reason, please become throughly familiar with the function of every control before attempting to operate the receiver.

### **FRONT PANEL**

### (1) ATT (ON, OFF)

The ATT switch activates an attenuator for the receiver front end to minimize overloading under extreme conditions of strong adjacent signals. Maximum receiver sensitivity occurs with the ATT switch OFF.

### (2) BAND

The BAND switch has five positions for selecting the proper preselector range for peaking the receiver circuits.

### (3) PRESELECT

The preselector peaks the receiver circuits for maximum sensitivity on the frequency being received. The preselector bands are color coded to match the color code of the band switch, and the preselector control should be tuned to the frequency in use by observation of the calibration marks on the color coded scale, and by listening for maximum signal or noise strength from the speaker.

### (4) POWER

This is the main on/off switch for the receiver. When it is in the OFF position, the timer circuit will turn the receiver on or off, according to the settings of SET 1 and SET 2 on the digital clock.

### (5) MHz

The MHz control selects the 1 MHz band to be tuned for reception. When the control is not set correctly, e.g. between the 6 MHz and 7 MHz segments, the UNLOCK lamp will light to indicate that adjustment is needed.

### (6) FINE

This control allows fine tuning of the received frequency.

### (7) MAIN TUNING KNOB

This is the main tuning control for the receiver.

### (8) DISPLAY (ON, OFF)

For conservation of energy, the front panel digital frequency display and lamps may be switched off with this button. The digital clock is not affected by this control.

### (9) MODE (LSB/CW, USB, AM, AM/ANL)

This control selects the desired mode:

LSB/CW: Lower sideband and CW

USB:

Upper sideband

AM:

Amplitude modulation

AM/ANL:

Amplitude modulation, automatic

noise limiter

### (10) VOL

This is the main volume control for the receiver.

### (11) TONE

This control varies the audio filter so as to emphasize either high or low audio tones.

### (12) REC

This jack is for recording purposes, and its output is set to approximately 50 mV, regardless of the setting of the volume control.

### (13) PHONES

This is a standard 1/4" headphone jack. When the headphone plug is inserted into the jack, the internal speaker is cut off.

### (14) TIMER

With proper setting of the SET 1 and SET 2 positions of the digital clock, placing the TIMER switch in the "down" position will allow automatic ON/OFF switching of the receiver by the digital clock.

### (15) FAST/SLOW

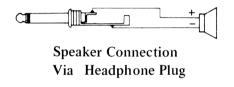
This lever switch is used for setting the digital clock. The fast speed is used for rapid advancement of the indicated time, and the slow speed is used for the final, fine adjustment.

### (16) HOLD

This lever switch will lock the digital clock on the indicated time. This switch is useful for alignment of the GMT and LOCAL indications, and also for time setting if the FAST/SLOW control advances the time too far.

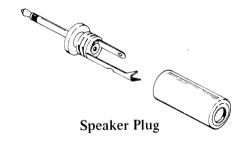
### (17) SELECT

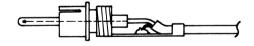
Each time the SELECT switch is pressed downward, the digital clock selection lamps are switched, corresponding to the change in the clock function. If the local time is being displayed (LOCAL lamp lighted), pressing the SELECT switch will cause the SET 1 lamp to light, and the clock will now display the time which has been programmed into the SET 1 position. Another press of the SELECT switch will cause SET 2 to be displayed, etc.

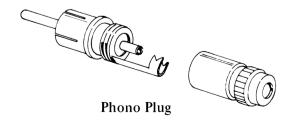




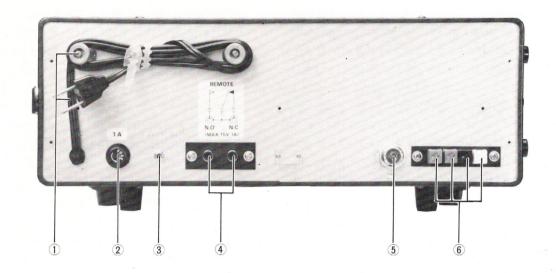
**Phone Plug** 







### REAR PANEL



### (1) POWER CORD AND CORD HOLDER

The power cord may be wrapped around the cord holder for packing purposes.

### (2) FUSE

For 100/110/117 volt operation, a 1 amp fuse should be installed here. For 200/220/234 volt operation, a 1/2 amp fuse should be installed. BE CERTAIN TO USE A FUSE OF THE PROPER RATING WHEN REPLACING FUSES.

### (3) EXT SP

This jack is for connection of an external speaker. The impedance is 4 ohms, and insertion of a plug into this jack disables the internal speaker.

# (4) REMOTE (N.O./N.C.) (N.O. = Normally Open; N.C. = Normally Closed)

These two phono jacks are used for switching peripheral station equipment such as tape recorders, etc. When the TIMER switch is activated, and the clock passes the SET 1 time, the relay is activated. When the SET 2 time is passed, the relay returns to its normal state. With the TIMER switch off, the relay is in its normal state. The relay contacts are rated at 15 V at 1A.

### (5) SW2

This is a standard UHF connector for coax-fed shortwave antennas.

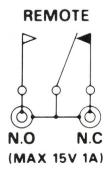
### (6) SW1, BC, E, MUTE

SW1 is a low-impedance connection for a randomlength shortwave antenna.

BC is a high-impedance connection for a random-length shortwave antenna.

E is a ground connection.

MUTE is a connection for muting FRG-7000, as, for example, with an external standby switch. Shorting the MUTE terminal to ground will mute the receiver.



### INSTALLATION

Carefully remove FRG-7000 from its carton, and inspect it for any signs of physical damage. Should any damage be observed, immediately notify the shipping company, stating the damage in detail. Save the carton and the packing material for possible future use.

### **LOCATION**

In general, the location of the FRG-7000 is not critical. However, it is recommended that excessively warm locations be avoided.

The FRG-7000 is supplied with a multi-voltage power transformer (export model only). Thus, when moving to an area where the supply voltage is different from your accustomed supply voltage, your FRG-7000 may still be used. Before commencing operation initially, BE SURE THAT THE VOLTAGE MARKED ON THE REAR OF THE RECEIVER AGREES WITH THE LOCAL AC SUPPLY VOLTAGE.

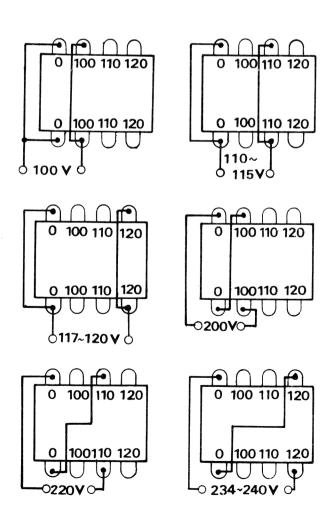


Fig.1 Transformer Primary Wiring

### **CAUTION**

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE RECEIVER. THE WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER AC SUPPLY VOLTAGE.

Should it become necessary to adapt the FRG-7000 to a different AC supply voltage, refer to the chart below for the proper connections. After modification, make a notation on the rear panel regarding the AC supply voltage in use.

If fuse substitution is required, be certain to use a fuse of the proper rating. For 100 - 117 volt operation, use a 1 amp fuse; for 200 - 234 volts, use a 1/2 amp fuse. The fuse holder is located on the rear apron. The counter unit also has a fuse of 3 amps (for all voltages). This fuse is installed inside the cabinet.

### **CAUTION**

BE CERTAIN TO USE A FUSE OF THE PROPER RATING. WARRANTY DOES NOT COVER DAMAGE CAUSED BY USE OF AN IMPROPER FUSE.

### ANTENNA AND GROUND

The antenna is the most important part of the communications receiver installation. The FRG-7000 is designed for use with a random-length antenna for 0.25 MHz - 1.6 MHz, and the antenna should be as long and high as possible. For 1.6 MHz - 29.9 MHz, maximum performance is secured through the use of a resonant antenna having an impedance of 50 to 75 ohms at the operating frequency. A center-fed dipole antenna cut for the desired frequency will easily satisfy this requirement, and it should be fed with coaxial cable. The length of a center-fed dipole can be determined by the formula

Length (feet) = 468/frequency (MHz) Length (meters) = 142.5/frequency (MHz)

The FRG-7000 should be connected to a good earth ground. The ground lead should be of a heavy-gauge braided cable or wire, and should be connected to the terminal marked E on the rear panel of the receiver.

### **OPERATION**

### FREQUENCY SELECTION

The operating frequency is read directly from the digital display. All digits of the operating frequency are displayed, with resolution to 1 kHz. The main tuning dial provides rapid frequency change, and the fine tuning control allows ±2.5 kHz adjustment for precise zeroing on the desired station.

The main tuning dial tunes a 1 MHz range, and thus controls the last three digits of the displayed frequency (000 to 999). For setting the digital display to the desired frequency, rotate the MHz control until the desired MHz range is reached, then rotate the main tuning dial to set the last three digits of the displayed frequency. The MHz control is somewhat critical in adjustment, and care should be taken to adjust it so that the UNLOCK lamp is not illuminated.

### PRESELECTOR OPERATION

For peaking the receiver circuits for maximum sensitivity on the desired frequency, the preselector must be tuned to that frequency. The BAND switch should be rotated so that the preselector band appropriate for the operating frequency is selected. For example, for peaking for reception on 6.910 MHz, the 4.0 MHz - 11.0 MHz (green) range should be selected.

Next, rotate the PRESELECTOR control and observe the color-coded calibration of the preselector dial drum. The calibration marking should correspond to the operating frequency; precise adjustment is made by peaking the noise level or signal strength at the speaker, while carefully adjusting the PRESELECTOR control. The ATT switch should be OFF during peaking of the preselector.

Refer to Table 1 for details regarding the various switch and controls.

	Frequency	PRESELECT	Main Dial	BAND	MODE
,	kHz 1,910	2.0	1.910 MHz	1.6~4.0	LSB·CW
	3,525	3.6 ■ 3.3 ■ 3	3.525 //	1.6~4.0	LSB·CW
	7,050	8 200 7 200 (	7.050 //	4.0~11.0	LSB·CW
Amateur	14,175	15 13 6	14.175 //	11.0~29.9	USB
	21,225	23 20	21.225 //	11.0~29.9	USB
	28,850	30 26 4	28.850 //	11.0~29.9	USB
	590	0.6	590 kHz	0.5~1.6	AM or AM/ANL
Medium Wave	980	1.0	980 //	0.5~1.6	AM or AM/ANL
	1,170	1.2 1.0	1.170MHz	0.5~1.6	AM or AM/ANL
	2,500	2.6 2.3	2.500MHz	1.6~4.0	AM or AM/ANL
	5,000	5 2 4.	5.000 //	4.0~11.0	AM or AM/ANL
WWA\111	10,000	11 = 10 = 9	10.000 //	4.0~11.0	AM or AM/ANL
	15,000	17 - 15	15 000 //	11.0~29.9	AM or AM/ANL
	3,925	4.0 3.6	3.925MHz	1.6~4.0	AM or AM/ANL
	5,980	6	5.980 //	4.0~11.0	AM or AM/ANL
	9,715	10 = 9	9.715 //	4.0~11.0	AM or AM/ANL
Short Wave	11,705	1,2 118	11.705 //	II.Q~29.9	AM or AM/ANL
	15,120	17 - 15 -	15.120 //	11.0~29.9	AM or AM/ANL
	17,880	20 17	17.880 //	11.0~29.9	AM or AM/ANL
	21,550	23 20 20	21.550 //	II. <b>,</b> 0∼29.9	AM or AM/ANL

Table 1

### BROADCAST BAND (0.5 MHz - 1.6 MHz) OPERATION

Special caution should be observed when attempting broadcast band reception, as the MHz control may appear to select more than one range for the segment of the band below 1 MHz. Use only the position of the MHz control immediately adjacent to the 1.0 MHz - 2.0 MHz band.

### SHORTWAVE BROADCAST RECEPTION

International shortwave broadcast stations use the AM mode. Turn the POWER switch ON (TIMER switch OFF), place the MODE switch in the AM position, and select the desired frequency as described in the previous section. The VOLUME control should be adjusted for a comfortable listening level. The TONE control may be adjusted to provide the desired fidelity, and the FINE control will allow precise adjustment of the received frequency.

In the presence of extremely strong signals, the ATT switch may be placed in the ON position to prevent overload of the receiver front end. Should impulse noise be present, the MODE switch may be placed in the AM/ANL position.

### AMATEUR BAND RECEPTION

### **SSB Voice Signals:**

Virtually all amateurs use lower sideband (LSB) on the frequency bands below 7.3 MHz, and upper sideband (USB) above 14.0 MHz. Set the MODE switch to USB or LSB, as appropriate, and rotate the main tuning dial until a signal is clearly heard. The FINE control is extremely useful when tuning in SSB signals. The VOLUME and TONE controls should be adjusted for the clearest reception level.

### CW (Morse Code Signals):

Amateur and commercial Morse Code transmissions may be received by placing the MODE switch in the LSB/CW position, and tuning the main dial and FINE controls for the desired listening tone.

	T:		RECEIVER		REM	OTE
Power Switch	Timer Switch		SET-I	SET-2	N.O.	N.C.
OFF	OFF	OFF	OFF	OFF	OPEN	CLOSE
ON	OFF	ON	ON	ON	OPEN	CLOSE
055	ON	٥٣٢	ON	_	CLOSE	OPEN
OFF	ON	OFF	_	OFF	OPEN	CLOSE
0.11			OFF	_	CLOSE	OPEN
ON	ON	ON	_	ON	OPEN	CLOSE

Table 2

### DIGITAL CLOCK OPERATION

The built-in digital clock will provide display of both your local time and Greenwich Mean Time (GMT). When the FRG-7000 is initially plugged in, the clock will indicate "00.00.00" and begin counting the seconds as they pass.

To set the clock to your local time, place the SELECT switch in the LOCAL position. Then use the FAST and SLOW switches to set the clock to the proper time. If desired, the clock may be set to some precise hour (for example, 11.00.00), and then the HOLD switch should be activated to hold the time at that point. When the time reaches exactly 11.00.00, release the HOLD switch, and the clock will resume counting. This technique is recommended for precise time calibration to a time standard such as WWV or JJY.

For setting to GMT time, it is recommended that the HOLD switch technique be used. Align the LOCAL time to a suitable point (e.g. 16.00.00) and activate the HOLD switch. Place the SELECT switch in the GMT position, and use the FAST and SLOW switch to calibrate the GMT clock with the GMT appropriate for the LOCAL time being held (e.g. 16.00.00 Eastern Standard Time = 21.00.00 GMT). Release the HOLD switch to start both clocks simultaneously.

The HOLD switch will freeze the time on both clocks. The FAST and SLOW switch will advance only the clock being displayed. The clock is operative as long as the FRG-7000 is plugged in.

### TIMER OPERATION

The SET 1 and SET 2 positions of the SELECT switch may be set to provide automatic ON and OFF control of the FRG-7000. For example, if a favorite program starts at 0730 local time, 07.30.00 may be stored in the SET 1 position for automatically turning the receiver on at that time. When it is desired to turn the receiver off automatically, that time may be stored in the SET 2 position. The TIMER circuitry may also be used for controlling peripheral equipment such as a tape recorder, as the timer relay actuates the REMOTE jacks on the rear apron.

The timer circuitry has the effect of switching the condition of the receiver as determined by the POWER switch. That is, when the POWER switch is OFF, and the TIMER switch ON, the receiver will be OFF until the SET 1 time. Between the SET 1 and SET 2 times, the receiver will be ON, and between the SET 2 and SET 1 times the receiver will again be OFF.

When the POWER switch is in the ON position, these relations are reversed. That is, with the POWER switch ON, and the TIMER switch ON, the receiver will be ON until the SET 1 time. From the SET 1 time until the SET 2 time, the receiver will be OFF, and after the SET 2 time the receiver will be ON until the SET 1 time.

The REMOTE contacts are controlled by the TIMER relay. In the period between the SET 1 and SET 2 times, the normally open (N.O.) jack will be CLOSED, and the normally closed (N.C.) jack will be OPEN. With the TIMER switch OFF, regardless of the position of the POWER switch, the jacks are in their "normal" states.

For example, if you must be away from your station, but want to record a program, proceed as follows: preset the receiver to the proper frequency and peak the preselector, etc. Connect the FRG-7000 REC jack to the recording input of the tape recorder, and connect the tape recorder "footswitch" jack to the REMOTE N.O. jack. Align the SET 1 time to the start of the program, and the SET 2 time to the end of the program. Place the POWER switch in the OFF position, and the TIMER switch ON. Place the tape recorder in the record condition; it should not operate because the REMOTE N.O. jack is open. When the SET 1 time is reached, the FRG-7000 will turn on, the tape recorder will be activated, and both will operate until the SET 2 time (the end of the program).

### CIRCUIT DESCRIPTION

The block diagram will provide you with a better understanding of this receiver. Basically, the FRG-7000 is a triple-conversion superheterodyne receiver utilizing a synthesized local oscillator for both the first and second mixers. The result is drift-free VFO operation.

The signal from the antenna is fed through the RF attenuator to the gate of the FET RF amplifier  $Q_{101}$  (3SK51-03). The amplified signal is fed through a low-pass filter (cutoff frequency 35 MHz) to the first balanced mixer, consisting of  $Q_{102}$  and  $Q_{103}$  (both 2SK19GR), where the incoming signal is mixed with a signal from the heterodyne oscillator. The first heterodyne oscillator,  $Q_{301}$  (2SC784O), provides a signal varying between 55.5 and 84.5 MHz.

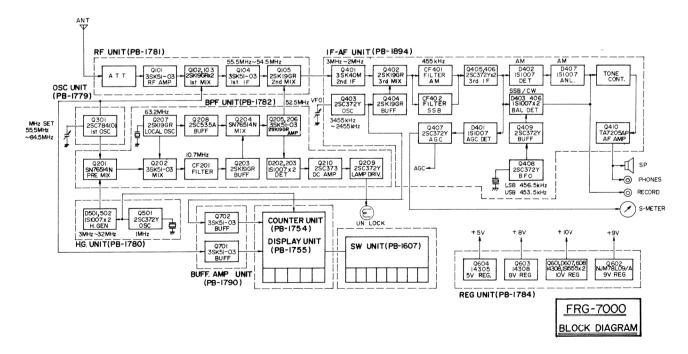
A 52.5 MHz heterodyne signal is produced as follows: the synthesized oscillator  $Q_{501}$  (2SC372Y) generates a 1 MHz signal, which is then fed to harmonic generator  $D_{501}$  -  $D_{502}$  (both 1S1007). This produces a series of harmonics from 3 to 32 NHz. This signal is fed to the first premixer,  $Q_{201}$  (SN76514), where the 55.5 MHz - 84.5 MHz and 3 MHz - 32 MHz signals are mixed, producing a 52.5 MHz signal.

The 52.5 MHz output signal from  $Q_{201}$  is fed to the second premixer  $Q_{202}$  (3SK51-03), where the 52.5 MHz signal is mixed with a 63.2 MHz signal generated by  $Q_{207}$  (2SK19GR), producing a 10.7 MHz IF signal.

The 10.7 MHz IF signal passes through a 10.7 MHz ceramic filter and is amplified by  $Q_{203}$  (2SK19GR) and fed to mixer  $Q_{204}$  (SN76514), where the 10.7 MHz signal is mixed with a 63.2 MHz signal generated by  $Q_{207}$ , producing a filtered 52.5 MHz signal.

The 52.5 MHz signal is then amplified by  $Q_{205}$  (3SK51-03) and  $Q_{206}$  (2SK19GR), and returned to the RF UNIT as the heterodyne signal for the second mixer,  $Q_{105}$  (2SK19GR). A portion of the output signal from  $Q_{206}$  is rectified by  $D_{202}$  (both 1S1007). The DC voltage is then amplified by  $Q_{210}$  (2SC372Y) and fed to the LOCK indicator driver  $Q_{209}$  (2SC372Y), which turns the LOCK lamp  $PL_3$  on when the synthesizer is unlocked.

The 54.5 MHz - 55.5 MHz signal is mixed with the 52.5 MHz heterodyne signal by  $Q_{105}$  (2SK19GR), resulting in a 2 MHz - 3 MHz IF



**BLOCK DIAGRAM** 

signal. This IF signal is amplified by  $Q_{401}$  (3SK40M) and fed to a third mixer  $Q_{402}$  (2SK19GR), where the IF signal is mixed with a 2455 kHz - 3455 kHz heterodyne signal, producing a 455 kHź third IF signal. The 2455 kHz - 3455 kHz heterodyne signal is generated by VFO oscillator  $Q_{403}$  (2SC372Y) and fed through buffer amplifier  $Q_{404}$  (2SK19GR) to  $Q_{402}$ . The 455 kHz IF signal is fed through a ceramic filter, CF-401, for AM, or CF-402 for SSB and CW, to eliminate adjacent-frequency interference.

The signal is then amplified by the third IF amplifier  $Q_{405}$  and  $Q_{406}$  (both 2SC372Y), and fed to the appropriate detector. The AM signal is detected by diode detector  $D_{402}$  (1S1007).

Balanced demodulator  $D_{403}$  -  $D_{406}$  (all **1S1007**) is used for the detection of SSB and CW signals. The carrier signal for SSB and the beat frequency signal for CW (generated by BFO oscillator  $Q_{408}$  (2SC372Y)) are fed to the balanced demodulator through buffer amplifier  $Q_{409}$ 

(2SC372Y). The MODE switch shifts the BFO frequency for reception of an LSB or USB signal.

The output from the detectors is amplified by  $Q_{410}$  (TA7205AP) for delivery to the speaker.

A portion of the output from the last IF amplifier  $Q_{406}$  is fed to the AGC (Automatic Gain Control) rectifier  $D_{401}$  (1S1007). The rectified AGC voltage is then amplified by AGC amplifier  $Q_{407}$  (2SC372Y) and fed to  $Q_{101}$ ,  $Q_{401}$ , and  $Q_{405}$  to control the gain of these stages automatically according to the strength of the received signal. Thus, the receiver output is not affected by variations in signal strength which may be caused by phase shift on the incoming signal. The S-meter is placed in the emitter circuit of  $Q_{407}$ , in which the emitter current changes in accordance with the incoming signal'strength.

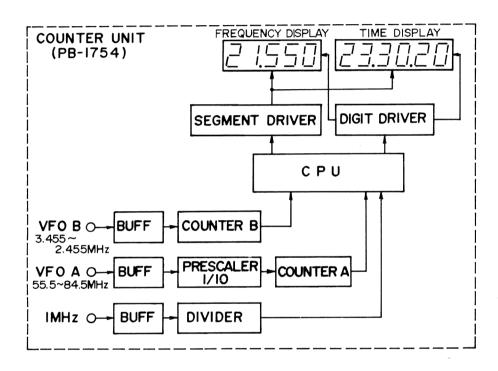
The 55.5 MHz - 84.5 MHz and 2455 kHz - 3455 kHz signals are amplified, respectively, by buffer amplifiers  $Q_{701}$  and  $Q_{702}$  (both 3SK51-03), and fed to the counter to display the received frequency.

FREQUENCY	1ST OSC	1ST IF (fo <sub>1</sub> - fi <sub>1</sub> )	REF FREQ	2ND OSC (fo <sub>1</sub> -fh)	2ND IF (fi <sub>1</sub> fo <sub>2</sub> )	3RD OSC	3RD IF (fo <sub>3</sub> -fi <sub>2</sub> )
f	fo <sub>1</sub>	fi <sub>1</sub>	fh	fo <sub>2</sub>	fi <sub>2</sub>	fo <sub>3</sub>	fi <sub>3</sub>
500kHz	55.5MHz	55.0MHz	3MHz	52.5MHz	2,500kHz	2,955kHz	455kHz
1,500	56.5	55.0	4	"	2,500	2,955	"
2,500	57.5	55.0	5	"	2,500	2,955	"
3,500	58.5	55.0	6	"	2,500	2,955	"
4,500	59.5	55.0	7	"	2,500	2,955	"
5,500	60.5	55.0	8	"	2,500	2,955	"
6,500	61.5	55.0	9	"	2,500	2,955	- "
7,500	62.5	55.0°	10	"	2,500	2,955	"
8,500	63.5	55.0	11	"	2,500	2,955	"
9,500	64.5	55.0	12	"	2,500	2,955	"
10,000	65.5	55.5	13	"	3,000	3,455	"
11,000	66.5	55.5	14	"	3,000	3,455	"
12,000	67.5	55.5	15	"	3,000	3,455	"
13,000	68.5	55.5	16	"	3,000	3,455	"
14,000	69.5	55.5	17	"	3,000	3,455	"
15,000	70.5	55.5	18	"	3,000	3,455	"
16,000	71.5	55.5	19	"	3,000	3,455	"
17,000	72.5	55.5	20	"	3,000	3,455	"
18,000	73.5	55.5	21	"	3,000	3,455	"
19,000	74.5	55.5	22	" .	3,000	3,455	"
20,000	75.5	55.5	23	"	3,000	3,455	"
21,100	76.5	55.4	24	n	2,900	3,355	"
22,200	77.5	55.3	25	"	2,800	3,255	"
23,300	78.5	55.2	26	11	2,700	3,155	11
24,400	79.5	55.1	27	"	2,600	3,055	"
25,500	80.5	55.0	28	"	2,500	2,955	n
26,600	81.5	54.9	29	"	2,400	2,855	"
27,700	82.5	54.8	30	"	2,300	2,755	"
28,800	83.5	54.7	31	"	2,200	2,655	"
29,900	84.5	54.6	32	"	2,100	2,555	"

Table 3 Frequency Relationship

The counter unit utilizes a 4-bit microcomputer unit (CPU) to display the frequency being received. The CPU also drives the digital clock, which displays both local and GMT time. The clock section of the CPU controls the timer function for ON/OFF control of the receiver and peripheral station equipment.

The regulated power supply consists of four regulators:  $Q_{601}$  (14308),  $Q_{602}$  (NJM 78L09A),  $Q_{603}$  (14308), and  $Q_{604}$  (14305), to deliver stabilized voltages of 10V, 9V, 8V, and 5V to various circuits in the receiver.



### MAINTENANCE & ALIGNMENT

### **GENERAL**

The FRG-7000 has been carefully aligned and tested at the factory prior to shipment, and, with normal usage, it should not require other than the usual attention given to electronic equipment. Service or replacement of a major component many entail substantial realignment; under no circumstances, however, should realignment be attempted unless the operation of the receiver is fully understood and the malfunction has been definitely attributed to misalignment rather than component failure. Service work should be performed by experienced personnel using proper test equipment.

### (1) Local Oscillator T<sub>207</sub>

Connect a VTVM between  $TP_{202}$  and  $TP_{204}$  (ground). Adjust  $T_{207}$  for 0.6V RMS as indicated on the VTVM. Connect a frequency counter to  $TP_{202}$ , and make sure that the output frequency is 63.2 MHz.

### (2) Output level $T_{201}$ - $T_{206}$

Connect a VTVM between  $\mathrm{TP_{108}}$  and  $\mathrm{TP_{109}}$  (ground). Set the FRG-7000 MHz control to 29 MHz. Carefully adjust the MHz control for a maximum VTVM reading. Then peak  $\mathrm{T_{201}}$  -  $\mathrm{T_{201}}$  for a maximum VTVM reading.

### (3) Harmonic generator TC<sub>501</sub>

Connect a frequency counter between  $TP_{502}$  and  $TP_{501}$  (ground), and adjust  $TC_{501}$  for a reading of 1 MHz. The output voltage at  $TP_{502}$  should be approximately 0.2V RMS.

### (4) Oscillator Unit T<sub>301</sub>, TC<sub>301</sub>

Connect a frequency counter between  $TP_{107}$  and  $TP_{104}$  (ground). Set the FRG-7000 MHz control to the fully counterclockwise position. Adjust  $T_{301}$  for a reading of 54.0 MHz on the counter. Set the MHz control to the fully clockwise position, and adjust  $TC_{301}$  for a reading of 85.2 MHz on the counter. Repeat the above adjustments, if necessary, until the UNLOCK lamp turns off at every 1 MHz incremental advancement of the MHz control.

### (5) VFO Frequency T<sub>403</sub>, TC<sub>403</sub>

This alignment should be performed after the receiver has been allowed to warm up 30 minutes. Connect a frequency counter between  $TP_{402}$  and  $TP_{404}$  (ground). Set the main tuning knob to the fully clockwise position, and adjust  $T_{403}$  for a reading of 2380 kHz on the counter. Set the main tuning knob next to the fully counterclockwise position, and adjust  $TC_{403}$  for a counter reading of 3480 kHz. Repeat this adjustment, if necessary, until complete tracking is accomplished The output voltage at  $TP_{402}$  should be 0.3V - 0.6V RMS.

## (6) Second IF Alignment $T_{401}$ , $T_{402}$ , $TC_{401}$ , $TC_{402}$

Connect a signal generator between  $TP_{105}$  and  $TP_{106}$  (ground). Set the MODE switch to the AM position, and set the signal generator output frequency to 2.1 MHz (the FRG-7000 display should indicate 900 kHz). Peak  $T_{401}$  and  $T_{402}$  for a maximum S-meter reading.

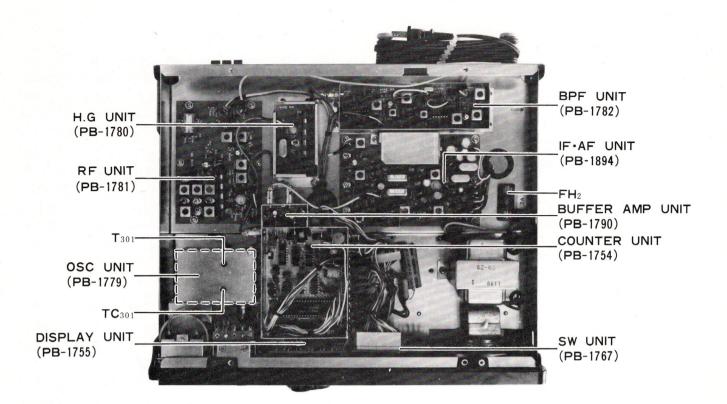
Set the signal generator to 2.9 MHz (the FRG-7000 digital display should indicate 100 kHz). Peak  $TC_{401}$  and  $TC_{402}$  for a maximum S-meter reading. Repeat the above adjustments until complete tracking is accomplished.

### (7) Third IF Alignment $T_{404}$ , $T_{405}$

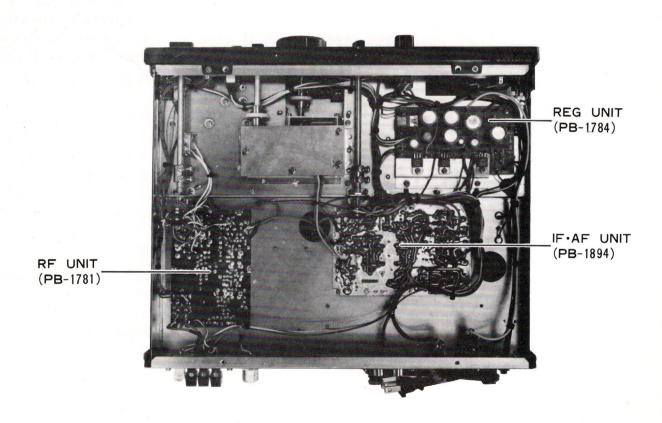
Connect a signal generator to  $TP_{401}$  and  $TP_{406}$  (ground), and set its output to 2.9 MHz (the FRG-7000 digital display should indicate 100 kHz). Peak  $T_{404}$  and  $T_{406}$  and  $T_{405}$  for a maximum S-meter reading.

### (8) S-meter Sensitivity VR<sub>401</sub>

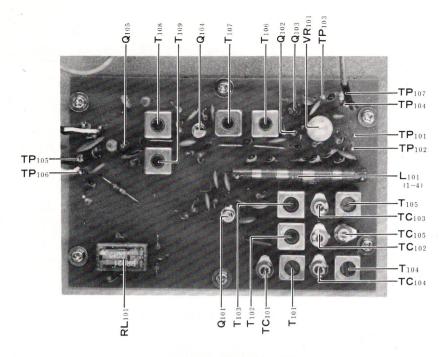
Connect a signal generator to SW2, and apply an 11 MHz 100 dB signal. Tune the receiver to 11 MHz, and adjust  $VR_{401}$  for a full scale reading on the S-meter.



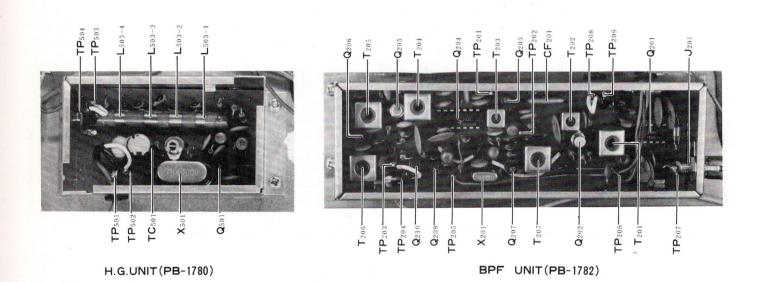
TOP VIEW

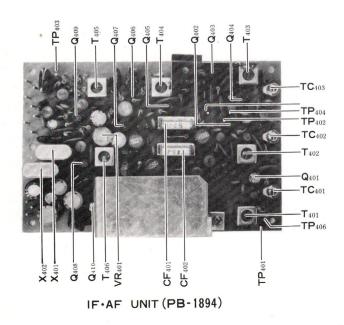


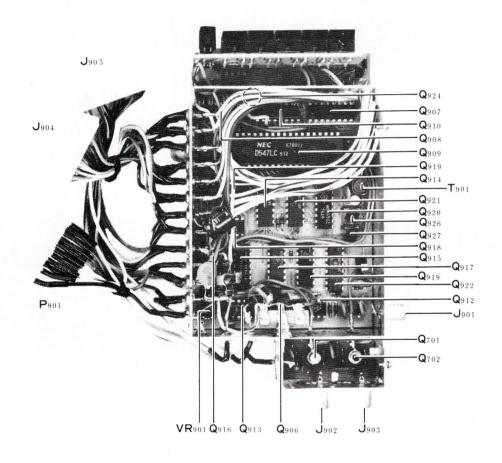
BOTTOM VIEW



RF UNIT(PB-1781)







COUNTER UNIT(PB-1754)

### PARTS LIST

	MA	IN CHASSIS		T	
Symbol No.	Part No.	Description			
- Cymber 110.	1	RESISTOR			
R5	40143470	Carbon film 1/4W VJ 47Ω			FUSE
R3, 6	41143680	" " TJ 68Ω	F1	73000013	1A (100V~117V)
R1	41143222	" " " 2.2kΩ		73000012	0.5A (200V~234V)
R2	40143223	" " " VJ 22kΩ	F2	73000003	3A
R4	42124120	" composition 1/2W GK 12Ω			
R7, 8, 9	42124225	" " " 2.2ΜΩ			
R10	44204339	Wire wound 2W 3.3Ω			
					FUSE HOLDER
			FH1	69030005	SN-1301
			FH2	69030003	F3294
		POTENTIOMETER			
VR1	49800104	DM10A $10k\Omega B/10k\Omega B$			
			_		PILOT LAMP
			PL1, 2, 13, 14	14000033	BQ-034-22529A
		CAPACITOR	PL3, 9~12	14000031	BQ-034-22527A
C2	31820050	Ceramic disc 50WV 5PF CH	PL4~8	14000032	BQ-034-22528A
C3	30820103	" " 0.01μF			
C1	36825104	Mylar " 0.1μF			
C4	34220108	Electrolytic 25WV TT 1000μF			
					RF UNIT
			Symbol No.	Parts No.	Description
				017811AZ	RF board with components
		VARIABLE CAPACITOR	PB-1781A	60417811	P.C. Board
VC1, 2	39000078	CY-31A 335PF x 2			
VC3	39000079	TSN 150S×04-1 4PF			
		, , , , , , , , , , , , , , , , , , ,			
					FET
			Q102, 103, 105	1	2SK19GR
	+	POWER TRANSFORMER	Q104	23800401	3SK40M
PT1	52000062	52-62	Q101	22800513	3SK51-03
	-				
	+				DIODE
			D101	21015550	DIODE Silicon 181555
	+	1	D101	21015550	Silicon 1S1555
	74000200	METER			
M1	74000380	KTC-024			
	-				RESISTOR
	<del> </del>		R121	40143100	Carbon film $1/4W$ VJ $10\Omega$
	-	CDEAKED	R119	40143330	" " " 33Ω
SP1	76000022	SPEAKER           SM-92Y         4Ω 4W	R120	40143330	" " " 47Ω
or I	70000022	31V1-72 1 432 4 W	R107, 122	40143470	" " " 100Ω
	<b>†</b>		R102, 108, 113,	<del></del>	" " " 220Ω
			116, 124	, , , , , , , , , , , , , , , , , , , ,	22000
	1	SWITCH	R103	41143221	" " TJ 220Ω
S1	62000002	ESR-E365R20A	R104, 105	40143561	" " VJ 560Ω
S2	62000020	ESR-E264R20	R112	40143681	" " " 680Ω
S3	65000012	PW-22	R115	40143152	" " " 1.5kΩ
S4	65000038	PW-42	R110,	40143103	" " " 10kΩ
S5	64000053	8H2011	R111	40143273	" " " 27kΩ
		†	R118	40143393	" " " 39kΩ
		<u> </u>	R117	40143473	" " " 47kΩ
	1		R101, 106, 109,		" " " 100kΩ
	<del></del>	RECEPTACLE	114, 123	1	
J1	68000011	M-BR-06D			
J2	68040006	SQ2450-03			
J3, 5	68020012	SG8050-07			
J4	68030002	SG7814			
Ј6	80043741	UP-021			

		POTENTIOMET		ļ	-	
VR101	49905472	SR19R 4	4.7kΩB			
					ļ	
						<del> </del>
TII101	20000005	THERMISTOR				BPF UNIT
TH101	29090005	D-22A		Symbol No.	Part No.	Description
	-	+		Symbol No.	017821AZ	BPF unit with components
	<u> </u>			PB-1782A	60417821	P.C. Board
		CAPACITOR		1B-1702A	00417821	1.C. Board
C119	31820020	Ceramic disc	50WV 2PF CH			
C106, 109, 124	<del></del>	" "	" 3PF "			
C111	31820050	" "	" 5PF "			IC, FET & TRANSISTOR
C120	31820150	" "	" 15PF "	Q201, 204	25000104	IC SN76514N
C113, 114, 126	31820220	" "	" 22PF "	Q203, 206, 207	22800195	FET 2SK19GR
C110, 130	31820270	" "	" 27PF "	Q202, 205	23800513	3SK51-03
C107, 108, 117	31820330	" "	" 33PF "	Q209	22303724	Transistor 2SC372Y
C125	31820820	" "	" 82PF "	Q210	22303730	2SC373
C116	31829101	" "	" 100PF SL	Q208	22305351	2SC535A
C132	30820102	" "	" 0.001μF	<u> </u>		
C101~105,	30820103	" "	" $0.01\mu$ F			
112, 115, 118,	I					21025
121~123, 127		, , ,	" 0.047μF	D202, 203	21010070	Germanium 1S1007
C128, 133 C131	30820473	Dipped mica	" 0.047μF " 47PF	D202, 203	21010070	Silicon 1S1555
C131	33824470 33824151	Dipped mica	" 4/PF " 150PF	D201	21013330	Silicon 151333
C129	33824131	<u>" "</u>	" 130FF			
		+				
						CRYSTAL
		-		X201	71500189	HC-18/U 63.2MHz
		+		7201	71300107	110 10/0 03.241112
# * * * * * * * * * * * * * * * * * * *		TRIMMER CAP	ACITOR			
TC102	39000002		0x32 20PF			
TC101, 103~	39000004		0x32 40PF			CERAMIC FILTER
105				CF201	71200020	10.7MF-S23 (SFG-10.7MA)
		TRANSFORME	R			
T101	55003293	R12-5830	#220360			RESISTOR
T102	55003200	R12-5828	#220046	R224	40143470	Carbon film 1/4W VJ 47Ω
T103	55003201	R12-5781	#220047	R207~209,	40143101	" " " 100Ω
T104	55003202	R12-5707	#220048	214~217		
T105	55003203	R12-5694	#220049	R210	40143151	" " " 150Ω
T106~109	55003204	R12-1041B	#220050	R206	40143221	" " " 220Ω
				R 219, 223	40143331	" " " 330Ω
, , , , , , , , , , , , , , , , , , ,		1		I D 202 220	40143471	" " " 470Ω
				R202, 220		
				R201	40143102	" " " 1kΩ
		INDUCTOR	W220051	R201 R222	40143102 40143472	" " " " 1kΩ " " " 4.7kΩ
L101	55003212		#220051	R201 R222 R204, 212, 221,	40143102 40143472	" " " 1kΩ
L103	53020018	Micro inductor	10μΗ	R201 R222 R204, 212, 221, 225	40143102 40143472 40143103	" " " 1kΩ " " 4.7kΩ " " 10kΩ
L103		Micro inductor		R201 R222 R204, 212, 221, 225 R203	40143102 40143472 40143103 40143273	" " " 1kΩ " " 4.7kΩ " " 10kΩ
L103	53020018	Micro inductor	10μΗ	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ " " 27kΩ " " " 33kΩ
L103	53020018	Micro inductor	10μΗ	R201 R222 R204, 212, 221, 225 R203	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ
L103	53020018	Micro inductor	10μΗ	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ " " 27kΩ " " " 33kΩ
L103 L102	53020018 53020008	Micro inductor " " F	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ " " 27kΩ " " " 33kΩ
L103 L102	53020018	Micro inductor	10μΗ	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ " " 27kΩ " " " 33kΩ
L103 L102	53020018 53020008	Micro inductor " " F	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 1kΩ " " 4.7kΩ " " 10kΩ " " 27kΩ " " " 33kΩ
L101 L103 L102	53020018 53020008	Micro inductor " " F	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211	40143102 40143472 40143103 40143273 40143333	" " " 4.7kΩ " " 10kΩ " " " 27kΩ " " " 33kΩ " " 47kΩ
L103 L102	53020018 53020008	Micro inductor " " F  RELAY BR 221D012	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211 R205, 213, 218	40143102 40143472 40143103 40143273 40143333 40143473	" " " 4.7kΩ " " 10kΩ " " " 27kΩ " " " 33kΩ " " 47kΩ
L103 L102	53020018 53020008 70000035	Micro inductor " " F  RELAY BR 221D012  US PIN PLUG	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211 R205, 213, 218	40143102 40143472 40143103 40143273 40143333 40143473	" " " 4.7kΩ " " 10kΩ " " " 27kΩ " " " 33kΩ " " 47kΩ
L103 L102	53020018 53020008	Micro inductor " " F  RELAY BR 221D012	10μH FL5H 68μH	R201 R222 R204, 212, 221, 225 R203 R211 R205, 213, 218	40143102 40143472 40143103 40143273 40143333 40143473	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

C213, 233,					
	31820101	Ceramic disc 50WV 100PF CH			
236, 238					CAPACITOR
C209, 210,	30820102	" " " 0.001μF	C301	31827070	Ceramic disc 50WV 7PF UJ
216, 220, 223,			C304	31827220	" " 22PF "
235, 239			C305	31827330	" " " 33PF "
C206, 214,	30820103	" " " 0.01μF	C302, 303	30820103	" " " 0.01μF
217~219,221,			C307, 308	30820473	" " " 0.047μF
222, 224, 227,			0001,000	50020175	0.01.72
229~232,234,					
237, 241					
C205, 207,	30820473	" " " 0.047μF			
208, 211, 215,					
225, 228					VARIABLE CAPACITOR
			VC301	39000074	C343C 15PFx4
					TRIMMER CAPACITOR
		TRANSFORMER	TC301	39000001	ECV-1ZW 10x32 10PF
T201, 204~206	55003294	#220361			
T207	55003295	#220362			
T202, 203	55003296	#220187			
					TRANSFORMER
			T301	55003208	#220052
		INDUCTOR			INDUCTOR
L201	55003206	#220053	L301	53010003	Micro inductor 250µH
L202	55003207	#220054			
L204, 206	53020013	Micro inductor 150µF		IE.	AF UNIT
L203, 205	53020013	" " 1mH	Symbol No.	Parts No.	Description
1203, 203	33020001		Symbol No.	018940AZ	IF, AF unit with components
			PB-1894	60418940	P.C. Board
			170-1074	00410940	1.C. Board
		US PIN JACK			
J101	68020008	SQ3056			IC, FET & TRANSISTOR
3101	0802000	3Q3030	Q410	25000162	IC TA7205A
			Q402, 404	22800195	FET 2SK19GR
	01100000	1 10	0401	22000401	EET 2CV/OM
	91100008	Wrapping terminal C	Q401	23800401	FET 3SK40M
	91100008	Wrapping terminal C	Q401 Q403,405~409	L	FET 3SK40M Transistor 2SC372Y
	91100008	Wrapping terminal C		L	
	91100008	Wrapping terminal C		L	Transistor 2SC372Y
	91100008	Wrapping terminal C	Q403,405~409	22303724	Transistor 2SC372Y
			Q403,405~409	22303724	Transistor 2SC372Y  DIODE  Germanium 1S1007
	C	DSC UNIT	Q403,405~409  D401~407 D408~411	22303724 21010070 21015550	Transistor   2SC372Y
Symbol No.	Part No.	DSC UNIT  Description	Q403,405~409  D401~407 D408~411 Q403,405~407,	22303724 21010070 21015550	Transistor 2SC372Y  DIODE  Germanium 1S1007
	C	DSC UNIT  Description  OSC board with components	Q403,405~409  D401~407 D408~411	22303724 21010070 21015550	Transistor 2SC372Y  DIODE  Germanium 1S1007  Silicon 1S1555  Transistor 2SC372Y
	Part No.	DSC UNIT  Description	Q403,405~409  D401~407 D408~411 Q403,405~407, 409	22303724 21010070 21015550 22303724	Transistor   2SC372Y
	Part No. 017791AZ	DSC UNIT  Description  OSC board with components	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401	22303724 21010070 21015550 22303724 71600035	DIODE
	Part No. 017791AZ	DSC UNIT  Description  OSC board with components	Q403,405~409  D401~407 D408~411 Q403,405~407, 409	22303724 21010070 21015550 22303724	DIODE
	Part No. 017791AZ	DSC UNIT  Description  OSC board with components	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401	22303724 21010070 21015550 22303724 71600035	DIODE
	Part No. 017791AZ	Description OSC board with components P.C. Board  TRANSISTOR	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401	22303724 21010070 21015550 22303724 71600035	DIODE
PB-1779A	Part No. 017791AZ	Description OSC board with components P.C. Board	Q403,405~409  D401~407  D408~411  Q403,405~407,  409  X401  X402	21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401	22303724 21010070 21015550 22303724 71600035	DIODE   Silicon   1S1555   Transistor   2SC372Y
PB-1779A	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR	Q403,405~409  D401~407  D408~411  Q403,405~407,  409  X401  X402	21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401	22303724 21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401	22303724 21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A Q301	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401	22303724 21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A  Q301  R304	Part No. 017791AZ 60417791	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401	22303724 21010070 21015550 22303724 71600035 71600034	DIODE
PB-1779A  Q301  R304 R303	Part No. 017791AZ 60417791 22307843 40143101 40143821	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402	22303724 21010070 21015550 22303724 71600035 71600034 71200012 71200021	DIODE
PB-1779A  Q301  R304 R303 R302	Part No. 017791AZ 60417791  22307843  40143101 40143821 40143472	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω " " " 820Ω " " " 4.7kΩ	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402  R429	21010070 21015550 22303724 71600035 71600034 71200012 71200021	DIODE
	Part No. 017791AZ 60417791 22307843 40143101 40143821	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω " " " 820Ω " " " 4.7kΩ	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402  R429 R439	21010070 21015550 22303724 71600035 71600034 71200012 71200021 40143150 40143470	DIODE   Germanium   181007   Silicon   181555   Transistor   28C372Y
PB-1779A  Q301  R304  R303  R302	Part No. 017791AZ 60417791  22307843  40143101 40143821 40143472	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω " " " 820Ω " " " 4.7kΩ	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402  R429	21010070 21015550 22303724 71600035 71600034 71200012 71200021 40143150 40143470	DIODE   Germanium   181007   Silicon   181555   Transistor   28C372Y
PB-1779A  Q301  R304  R303  R302	Part No. 017791AZ 60417791  22307843  40143101 40143821 40143472	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω " " " 820Ω " " " 4.7kΩ	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402  R429 R439	21010070 21015550 22303724 71600035 71600034 71200012 71200021 40143150 40143470	DIODE   Sermanium   181007   Silicon   181555   Transistor 28C372Y
PB-1779A  Q301  R304  R303  R302	Part No. 017791AZ 60417791  22307843  40143101 40143821 40143472	Description OSC board with components P.C. Board  TRANSISTOR  2SC784 O  RESISTOR  Carbon film 1/4W VJ 100Ω " " " 820Ω " " " 4.7kΩ	Q403,405~409  D401~407 D408~411 Q403,405~407, 409  X401 X402  CF401 CF402  R429 R439	21010070 21015550 22303724 71600035 71600034 71200012 71200021 40143150 40143470	DIODE   Germanium   181007   Silicon   181555   Transistor   28C372Y

R408, 410, 414						
R408, 410, 414, 414, 414, 424, 433, 433, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 437, 435, 447, 437, 437, 437, 437, 437, 437, 437	R420, 421					
A44, 426, 433, 435						OZII
445, 437, 438		l .	" " " 220Ω			12011
R410		,			32824271	" " " 270PF
R430	435, 437, 453			C441	32824391	" " " 390PF
R449	R401	40143331	" " " 330Ω	C432	32824471	" " " 470PF
R431	R430	40143471	" " " 470Ω	C462	32824681	" " " 680 <b>P</b> F
R415, 440,458         40143102         " " " " 15kΩ         C4227         36825472         " " 0.00           R416         40143152         " " " 15kΩ         C426         36825103         " 0.01           R415, 418, 419, 419         40143222         " " " 2.2kΩ         C437         36825223         " 0.02           R415, 417, 428, 40143332         " " " 3.3kΩ         C416, 420, 422         36825233         " 0.03           R418, 417, 428, 40143332         " " " 3.3kΩ         C416, 420, 422         36825104         " 0.04           R448         40143392         " " " 3.3kΩ         C445         36825104         " 0.1μ           R452         40143472         " " " 8.2kΩ         C442         3682524         " 0.22           R417         40143503         " " " 15kΩ         C428         36825246         " 0.22           R427         40143103         " " " 15kΩ         C439         3422025         " 2.2kΩ           R459, 400         40143133         " " 18kΩ         C439         34220105         " 2.2kΩ           R459         40143333         " " 3.3kΩ         C440, 467, 469         34220107         " 7 47μ           R459         40143333         " " 3.3kΩ         C4704, 469         34220107         "	R449	40143561	" " " 560Ω	C431, 463	32824102	" " 1000PF
R416	R431	40143681	" " " " 680Ω		36825332	Mylar " 0.0033μF
R415, 418, 419, 40143222   " " " " 2.2kt2   C437   36832223   " 0.002   C42, 455, 457   C436   5885333   " 0.03   C426   C436   C4365333   " 0.03   C436   C436   C4365333   " 0.03   C436   C436   C4365333   " 0.03   C436   C436   C436   C4365333   " 0.03   C436   C4	R425, 440, 458	40143102	" " " " 1kΩ	C427	36825472	" " $0.0047 \mu F$
C436   36825333   "	R416	40143152	" " " 1.5kΩ	C426	36825103	" " 0.01μF
R413, 417, 428, 40143392	R415, 418, 419,	40143222	" " " 2.2kΩ	C437	36825223	" " 0.022μF
R413, 417, 428, 40143322	422, 455, 457			C436	36825333	" " 0.033μF
R448		40143332	" " " 3.3kΩ	1		
R452		40143392	" " " 3.9kΩ		36825104	" " 0.1μF
R411						
R427				C120		
Mode				C425 447		
R450, 460	1427					
Hold	D450 460			C+37		
R459	K43U, 46U			C442 446 449		
R406	D450					
R404				C440, 467, 469	34220107	" " 100μF
R402						
R416						
R412, 434, 441	R402	40143563	" " " " 56kΩ			
TC403   39000002   ECV-IZW   20x32   20PF	R436	40143683	" " " " 68kΩ			
R405	R412, 434, 441,	40143104	" " " 100kΩ			TRIMMER CAPACITOR
R423, 438	456			TC403	39000002	ECV-1ZW 20x32 20PF
TRANSFORMER   T401   \$5003209   R12-5783   #220   T402   \$5003210   R12-5780   #220   T402   \$5003211   R12-5775   #220   T404, 405   \$54140970   R12-4097   #220   T406   \$54140970   R12-4099   #220   T406   \$54140990   R12-4099   #220   T406   T406   T5414090   R12-4099   #220   T406   T5414090   R12-4099   #220   T5414090   R12-4099   #220   T5414090   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R1	R405	40143154	" " " 150kΩ	TC401, 402	39000005	ECV-1ZW 50x32 50PF
TRANSFORMER   T401   \$5003209   R12-5783   #220   T402   \$5003210   R12-5780   #220   T402   \$5003211   R12-5775   #220   T404, 405   \$54140970   R12-4097   #220   T406   \$54140970   R12-4099   #220   T406   \$54140990   R12-4099   #220   T406   T406   T5414090   R12-4099   #220   T406   T5414090   R12-4099   #220   T5414090   R12-4099   #220   T5414090   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R12-4099   #220   T5414090   R12-4099   R1		40143224				
T401   S5003209   R12-5783   #220   T402   S5003210   R12-5780   #212   T403   S5003211   R12-57780   #212   T403   S5003211   R12-57780   #212   T403   S5003211   R12-57780   #212   T403   S5003211   R12-57780   #212   T404   405   S4140970   R12-4097   #220   T406   S4140990   R12-4097   #220   T406   S4140990   R12-4099   #220   T406   T409						TD 411050D1150
THA01   29090005	-			T401	55002200	
TH401 29090005 D-22A T404, 405 55003211 R12-5775 #226 T404, 405 54140970 R12-4097 #226 T406 54140990 R12-4099 #226  POTENTIOMETER L401, 402 53020022 Micro inductor FL4H 4.7 VR401 49905471 SR19R 470ΩB L414 53020024 " " FL5H 170 L415 53020023 " " FL5H 170 L403 53020003 " " FL5H 170 L403 53020001 " " FL5H 170 L404 406, 407, 53020003 " " FL5H 170 L404, 406, 407, 53020003 " " FL5H 170 L404, 406, 407, 53020003 " " FL5H 170 L404, 406, 407, 53020003 " " FL5H 170 L405, 408, 409, 53030003 " (shielded) S6-392 3.9 C434 3182020 " " " 22PF CH C461 31820220 " " " 22PF CH C465 31820270 " " " 22PF CH C466 31820270 " " " 22PF CH C459 31827820 " " " 82PF UJ P401 6702007 SQ4052 C424 3082010 " " " 150PF SL C453 31829151 " " " 150PF SL C454 3182921 " " " 220PF SL C455 30820103 " " " 0.001μF C401, 402, 406, 30820103 " " " 0.001μF C401, 402, 406, 30820103 " " " 0.001μF C401, 402, 406, 30820103 " " " 0.001μF C403, 404, 405, 30820103 " " " 0.001μF C404, 404, 406, 406, 30820103 " " " 0.001μF C405, 408, 417, 433, 451, 452, 455, 464, 466 C403, 404, 405, 30820473 " " " 0.047μF Symbol No. Parts No. Description C457, 409 441, 418, 429, 449, 450, 464, 466 C403, 404, 405, 30820473 " " " 0.047μF Symbol No. Parts No. Description C457, 409 441, 418, 429, 449, 450, 464, 466 C403, 404, 405, 30820473 " " " 0.047μF Symbol No. Parts No. Description C457, 409 441, 418, 429, 449, 450, 464, 466 C403, 404, 405, 30820473 " " " 0.047μF Symbol No. Parts No. Description C457, 409 441, 418, 429, 449, 450, 464, 466 C403, 404, 405, 30820473 " " " 0.047μF Symbol No. Parts No. Description C457, 407 407 407 407 407 407 407 407 407 407						
TH401   29090005			THERMICTOR			
T406   S4140990   R12-4099   #2200	mrr 101	20000005				
NR   NR   NR   NR   NR   NR   NR   NR	TH401	29090003	D-22A			
VR401				T406	54140990	R12-4099 #220156
VR401				-		INDUCTOR
VR401         49905471         SR19R         470ΩB         L414         53020024         " " FL5H 27μ           L415         53020023         " " FL5H 100         L403         53020001         " " FL5H 100           L403         53020001         " " FL5H 100         L404, 406, 407, 53020003         " " FL7H 3.9           C415, 419         31820010         Ceramic disc 50WV         1PF CH         L405, 408, 409, 53030003         " (shielded) S6-392 3.9           C434         31820070         " " " 10PF CH         L405, 408, 409, 53030003         " (shielded) S6-392 3.9           C430         31820100         " " " 22PF CH         L405, 408, 409, 53030003         " (shielded) S6-392 3.9           C461         31820220         " " " 22PF CH         L5000000         US PIN PLUG           C459         31827820         " " " 82PF UJ         P401         67020007         SQ4052           C421, 423         31829101         " " " 150PF SL         91100008         Wrapping terminal C           C453         31829221         " " " 0.001μF         80022070         Heat sink           C424         30820103         " " " 0.001μF         80022070         Heat sink           C401, 402, 406, 406, 406, 406, 406, 406, 406, 406			POTENTIOMETER	L401, 402	53020022	
L415   53020023   "   FL5H 100	VR401	49905471				
L403   53020001   "   FL5H Im						
CAPACITOR						
C415, 419   31820010   Ceramic disc 50WV   1PF CH   L405, 408, 409, 53030003   " (shielded) S6-392 3.9						
C415, 419         31820010         Ceramic disc 50WV         1PF CH         L405, 408, 409, 53030003         " (shielded) S6-392 3.9           C434         31820070         " " " 7PF CH         413, 416         413, 416         " (shielded) S6-392 3.9           C430         31820100         " " " 10PF CH         413, 416         US PIN PLUG           C461         31820220         " " " 22PF CH         US PIN PLUG           C459         31827820         " " " 100PF SL         US PIN PLUG           C453         31829101         " " " 150PF SL         91100008         Wrapping terminal C           C454         31829221         " " " 220PF SL         91100008         Wrapping terminal C           C424         30820102         " " " 0.001μF         80022070         Heat sink           C401, 402, 406, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466         " " 0.047μF         HG UNIT           408, 417, 433, 451, 452, 455, 454, 455, 457, 470         PB-1780A         60417801         P.C. Board			CAPACITOR		55020003	1 L/11 3.7mm
C434         31820070         " " " TPF CH         413, 416           C430         31820100         " " " 10PF CH           C461         31820220         " " " 22PF CH           C465         31820270         " " " 82PF UJ           C459         31827820         " " " 82PF UJ           C421, 423         31829101         " " 100PF SL           C453         31829151         " " 150PF SL           C454         31829221         " " 220PF SL           C424         30820102         " " 0.001μF           C401, 402, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466         " " 0.047μF           C403, 404, 405, 405, 464, 466         " " 0.047μF           C403, 404, 405, 405, 452, 455, 455, 457, 470         " " 0.047μF           PB-1780A         60417801         P.C. Board	C415 410	31820010			53020002	" (chielded) \$6 202 2 0 mH
C430       31820100       " " " 10PF CH         C461       31820220       " " " 22PF CH         C465       31820270       " " " 27PF CH         C459       31827820       " " 82PF UJ       P401       67020007       SQ4052         C421, 423       31829101       " " 100PF SL       91100008       Wrapping terminal C         C453       31829151       " " 220PF SL       91100008       Wrapping terminal C         C454       31829221       " " 0.001μF       80022070       Heat sink         C401, 402, 406, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466       " " 0.01μF       HG UNIT         C403, 404, 405, 404, 405, 408, 417, 433, 451, 452, 455, 455, 457, 470       " " 0.047μF       Symbol No. Parts No. Description         PB-1780A       60417801       P.C. Board					33030003	" (sincided) 50-392 3.9 mH
C461       31820220       " " " 22PF CH         C465       31820270       " " " 82PF CH         C459       31827820       " " 82PF UJ       P401       67020007       SQ4052         C421, 423       31829101       " " 100PF SL       91100008       Wrapping terminal C         C453       31829151       " " 220PF SL       91100008       Wrapping terminal C         C454       31829221       " " 220PF SL       80022070       Heat sink         C424       30820102       " " 0.001μF       80022070       Heat sink         C401, 402, 406, 406, 409~414, 418, 429, 449, 450, 464, 466       HG UNIT       Symbol No. Parts No. Description         C403, 404, 405, 30820473       " " 0.047μF       Symbol No. Parts No. Description         457, 470       PB-1780A       60417801       P.C. Board				413, 416		
C465       31820270       " " " 27PF CH       US PIN PLUG         C459       31827820       " " " 82PF UJ       P401       67020007       SQ4052         C421, 423       31829101       " " 100PF SL       91100008       Wrapping terminal C         C453       31829151       " " 220PF SL       91100008       Wrapping terminal C         C454       31829221       " " 0.001μF       80022070       Heat sink         C424       30820102       " " 0.01μF       80022070       Heat sink         C401, 402, 406, 409~414, 418, 429, 449, 450, 464, 466       " " 0.047μF       HG UNIT         C403, 404, 405, 404, 405, 408, 417, 433, 451, 452, 455, 455, 455, 457, 470       PB-1780A       Farts No. 60417801       Description						
C459       31827820       " " " 82PF UJ       P401       67020007       SQ4052         C421, 423       31829101       " " 100PF SL       91100008       Wrapping terminal C         C453       31829151       " " 220PF SL       91100008       Wrapping terminal C         C454       31829221       " " 0.001μF       80022070       Heat sink         C424       30820102       " " 0.001μF       80022070       Heat sink         C401, 402, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466       HG UNIT       HG UNIT         C403, 404, 405, 404, 405, 408, 417, 433, 408, 417, 433, 451, 452, 455, 455, 455, 457, 470       PB-1780A       Farts No. Description         PB-1780A       Farts No. Description						
C421, 423       31829101       " " 100PF SL       91100008       Wrapping terminal C         C453       31829151       " " 220PF SL       91100008       Wrapping terminal C         C454       31829221       " " 0.001μF       80022070       Heat sink         C424       30820102       " " 0.001μF       80022070       Heat sink         C401, 402, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466       " " 0.047μF       HG UNIT         C403, 404, 405, 404, 405, 408, 417, 433, 451, 452, 455, 455, 451, 452, 455, 457, 470       PB-1780A       PB-1780A       HG unit with components			I	1		
C453       31829151       " " " 150PF SL       91100008       Wrapping terminal C         C454       31829221       " " " 220PF SL       80022070       Heat sink         C424       30820102       " " " 0.001μF       80022070       Heat sink         C401, 402, 406, 406, 407, 409~414, 418, 429, 449, 450, 464, 466       " " 0.047μF       HG UNIT         C403, 404, 405, 408, 417, 433, 408, 417, 433, 451, 452, 455, 455, 457, 470       PB-1780A       PB-1780A       HG unit with components         457, 470       PB-1780A       60417801       P.C. Board				P401	67020007	SQ4052
C454 31829221 " " " 220PF SL						
C424 30820102 " " " 0.001μF 80022070 Heat sink  C401, 402, 406, 30820103 " " " 0.01μF  407, 409~414, 418, 429, 449, 450, 464, 466  C403, 404, 405, 30820473 " " 0.047μF  408, 417, 433, 451, 452, 455, 017801AZ HG unit with components 457, 470  PB-1780A 60417801 P.C. Board	C453	31829151	" " 150PF SL		91100008	Wrapping terminal C
C401, 402, 406, 30820103 " " " 0.01μF		31829221	l			
407, 409~414, 418, 429, 449, 450, 464, 466  C403, 404, 405, 408, 417, 433, 451, 452, 455, 457, 470  PB-1780A  HG UNIT  Symbol No. Parts No. Description 017801AZ HG unit with components PB-1780A 60417801 P.C. Board	C424	30820102	" " " 0.001μF		80022070	Heat sink
407, 409~414, 418, 429, 449, 450, 464, 466  C403, 404, 405, 408, 417, 433, 451, 452, 455, 457, 470  PB-1780A  HG UNIT  Symbol No. Parts No. Description 017801AZ HG unit with components PB-1780A 60417801 P.C. Board	C401, 402, 406,	30820103	" " " 0.01μF			
418, 429, 449, 450, 464, 466  C403, 404, 405, 408, 417, 433, 451, 452, 455, 457, 470  PB-1780A  HG UNIT  Symbol No. Parts No. Description 017801AZ HG unit with components PB-1780A 60417801 P.C. Board						
450, 464, 466 C403, 404, 405, 30820473 " " 0.047μF  HG UNIT  Symbol No. Parts No. Description  451, 452, 455, 017801AZ HG unit with components  457, 470 PB-1780A 60417801 P.C. Board						
C403, 404, 405, 404, 405, 408, 417, 433, 451, 452, 455, 470       " " 0.047μF       HG UNIT         Symbol No.       Parts No.       Description         Symbol No.       Parts No.       Description         457, 470       PB-1780A       60417801       P.C. Board						
408, 417, 433,         Symbol No.         Parts No.         Description           451, 452, 455,         017801AZ         HG unit with components           457, 470         PB-1780A         60417801         P.C. Board		30820473	" " " 0.047E	232337		IG UNIT
451, 452, 455,       017801AZ       HG unit with components         457, 470       PB-1780A       60417801       P.C. Board		30020473	υ.υ4/μΓ			
457, 470 PB-1780A 60417801 P.C. Board				Symbol No.		
				DD 1700 1		
C456 32824200 Dipped mica " 20PF		22021222	D: 1 : 20DF	rb-1/80A	6041/801	r.C. Board
	C436	32824200	Dipped mica " 20PF			

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		TRANSISTOR		NASSANIE Mark	REG UNIT
Q501	22303724	2SC372Y	Symbol No.	Part No.	Description
				017841AZ	Regulator unit with components
			PB-1784A	60417841	P.C. Board
		DIODE			
D501, 502	21010070	Germanium 1S1007			
					IC
	1		Q604	25000105	μPC 14305
			Q601, 603	25000116	μPC 14308
		CRYSTAL	Q602	25000170	NJM 78L09A
X501	71600026	HC-6/W 1MHz			
					DIODE
		RESISTOR	D607, 608	21015550	Silicon 1S1555
R505, 506	40143101	Carbon film 1/4W VJ 100Ω	D601~606	21090022	" V06B
R503	40143221	" " " 220Ω			
R502	40143103	" " " 10kΩ			
R501	40143104	" " " 100kΩ			
	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				RESISTOR
			R602	42124220	Carbon composition 1/2W GK 2
				+	
		CAPACITOR			
C502, 510	31820080	Ceramic disc 50WV 8PF CH			
		" " " 15PF "			CAPACITOR
C511	31820150 31820270	" " " 27PF "	C610, 611	30820473	Ceramic disc 50WV $0.047\mu$ F
C509, 514		" " 33PF "	C605	34220336	Electrolytic 16WV 33µF
C508	31820330		C604, 607,	34220107	" " 100µF
C506	31820680		608	34220107	100μ1
C501, 504,	30820103	" " " 0.01μF		24220100	" " 1000μF
505, 507	22021020	D: 1 : 02DE	C606, 609	34220108	
C503	33824820	Dipped mica " 82PF	C601~603	34320108	" 25WV 1000μF
C512	34220476	Electrolytic 16WV TW 47μF			
					RELAY
			77.601	70000026	+
			RL601	70000036	AW 62209 HB2-DC 6V
		TRIMMER CAPACITOR			-
TC501	39000004	ECV-1ZW 40x32 40PF			
					MINI CONNECTOR
			J601	68110008	5047-11 #240063A
		INDUCTOR	(with wire)		
L503	55000012	#220051			
L502	53020022	Micro inductor FL4H 4.7mH		91100008	Wrapping terminal C
L501	53020001	" " FL5H 1mH			
L504	53020003	" " FL7H 3.9mH			
		US PIN PLUG		BUF	FER AMP UNIT
P501, 502	67020007	SQ4052	Symbol No.	Part No.	Description
				017901AZ	Buffer board with components
			PB-1790A	60417901	P.C. Board
	91100008	Wrapping terminal C			
					FET
			Q701, 702	23800401	3SK40M
			×, 01, 702		

		RESISTOR		T	SWITCH
R703, 709	40143221	Carbon film 1/4W VJ 220Ω	S801	64000107	SLE 72251
R704	40143152	,	S802		
	1	1.5886		64000103	SLE 62251
R710	40143272	" " " 2.7kΩ	S803	64000106	SLE 82301
R702, 707	40143333	" " " 33kΩ	S804	64000108	SLE 64251
R705, 708	40143473	" " " 47kΩ			
R701, 706	40143474	" " " 470kΩ			
			J801	(00(0000	MINI CONNECTOR
		-		68060008	3024-15C
			P801, 802	67150008	5048-15A
			P803	68150006	3094-15A
0701 704	20020102	CAPACITOR			
C701~704	30820103	Ceramic disc 50WV 0.01µF			
C705	36226105	Tantalum 16WV 1µF		ļ	
C706	32821102	Feed thru 50WV 0.001µF			
	91001102	Seal terminal A102		CO	UNTER UNIT
	71001102	Sour terminar /1102	Symbol No.	Part No.	Description
	91100008	Wrapping terminal C		017541AZ	Counter unit assembly
					with Buffer Display board
			PB-1754A	60417541	P.C. Board
			PR-1755	60417550	P.C. Board
Symbol No.	SV Part No.	Description			IC & TRANSISTOR
	017671AZ	Switch board with components	Q907, 910	25000143	IC MC1416
PB-1767A	60417671	P.C. Board	Q918	25000143	MC14518
	00417071	r.e. board	Q919	25000174	1
				1	MC14519
			Q920	25000053	MSM5502
			Q912	25000067	MSM5592
		IC & TRANSISTOR	Q915, 923	25000140	SN74LS00N
Q801	25000114	IC MC14011	Q914, 921	25000171	SN7407N
Q803	25000176	MC14016	Q917	25000072	SN74LS90N
Q802	25000156	MC14027	Q913	25000170	SN74LS112N
Q804	25000093	MC14081	Q922	25000161	SN74LS390N
Q805~808	22303730	Transistor 2SC373	Q916	25000159	SP8646
Q809	21090147	Display 5082-7286	Q908	25000157	μPA56C
			Q909	25000158	μPA547C-1
	1		Q906	25000172	NJM78L05A
			Q926, 927, 928		Transistor 2SC373
	1	DIODE	Q920, 927, 928 Q911	22303730	2SC828
D801~806	21015550	1	Q924, 925	22390001	MPSA13
D001~000	21013330	Silicon 1S1555	Q924, 925 Q901~905	21090135	MPSA13  Display 5082-7740
701000000000000000000000000000000000000			Q301~303	21070133	Display 3002-1/40
D.000 005	40104455	RESISTOR			
R802~806 R801	42184103	Carbon composition 1/8W GK 10kΩ			5.055
K ALLI	42184473	" " " 47kΩ	D001 002 005	21015550	DIODE
1.001			D901, 902, 905	21013330	Silicon 1S1555
				21000001	TED 01100D
			D903, 904	21090091	LED SL103D
				21090091	LED SL103D
		CARACITOR		21090091	LED SL103D
	30820102	CAPACITOR  Caramic disc. SOWY 0.001E		21090091	
C802	30820102	Ceramic disc 50WV 0.001µF	D903, 904		RESISTOR
C802 C801	30820473	Ceramic disc 50WV 0.001µF " " 0.047µF	D903, 904  R922, 949~955	40143390	RESISTOR Carbon film RD1/4(F) $39\Omega$
C802 C801 C804	30820473 33824470	Ceramic disc 50WV 0.001μF  " " 0.047μF  Dipped mica " 47PF	D903, 904  R922, 949~955 R924, 928, 93C,	40143390	RESISTOR
C802 C801 C804	30820473	Ceramic disc 50WV 0.001µF " " 0.047µF	R922, 949~955 R924, 928, 93C, 956	40143390 40143221	RESISTOR  Carbon film RD1/4(F) 39Ω  " " 220Ω
C802 C801 C804	30820473 33824470	Ceramic disc 50WV 0.001μF  " " 0.047μF  Dipped mica " 47PF	R922, 949~955 R924, 928, 93C, 956 R958	40143390 40143221 40143271	RESISTOR Carbon film RD1/4(F) $39\Omega$
C802 C801 C804	30820473 33824470	Ceramic disc 50WV 0.001μF  " " 0.047μF  Dipped mica " 47PF	R922, 949~955 R924, 928, 930, 956 R958 R903, 908, 909,	40143390 40143221 40143271	RESISTOR  Carbon film RD1/4(F) 39Ω  " " 220Ω
C802 C801 C804 C803	30820473 33824470	Ceramic disc 50WV 0.001μF  " " 0.047μF  Dipped mica " 47PF	R922, 949~955 R924, 928, 93C, 956 R958	40143390 40143221 40143271 40143102	RESISTOR  Carbon film RD1/4(F) 39Ω  " " 220Ω  " " 270Ω

R902	40143332	" " 3.3kΩ	1	1	US PIN JACK
R918	40143472	" " 4.7kΩ	J901~903	68020008	SQ3056
R927, 929, 959	1	" " " 5.6kΩ		0002000	
R910~917	40143103	" " 10kΩ			
R920, 923,	40143223	" " " 22kΩ			
939~941	.01.0220	ZZRSC			IC SOCKET
R901	40143273	" " 27kΩ	QS901~905	68140005	314-AG37D
R957	40143563	" " " 56kΩ	QS906	68420001	116-42-30-114
R904, 906, 931		" " 100kΩ	QB700	00420001	110 12 30 11 1
R905	+	" " 150kΩ			
R942	40143154	TORES	-	67200003	Board joint 163740
R932	47000003	Block resistor 220Ωx7	+	07200003	Board Joint 1037 10
K932	47000007	" " 22kΩx7			
				ACCES	SORIES °
			Symbol No.	Part No.	Description
			-	67020003	Record plug & external Speaker plug P2240
	-			67020002	Headphone plug SH3001
	<b>†</b>	POTENTIOMETER		67020001	RCA Pin plug CN7017P
VR901	49800083	PH822H501 500ΩB		67000005	Antenna plug MP-5
, 11, 701	1,500003			96000025	Antenna wire A #250003
				96000025	Antenna wire B #250004
				73000013	Fuse (F1) 1A (100V~117V)
				73000013	0.5A (200V~234V)
		CAPACITOR			Fuse (F2) 3A
C901, 902, 904	30820103	Ceramic disc 50WV 0.01µF	-	73000003	1 use (1 2) 3A
912, 913, 942					
C908, 910	30820473	0.017			
C944	33824300	Dipped inited			
C907	33824151	" " 150PF			
C903, 905	36133104	Mylar 100WV 0.1μF (B32560-A11045)			
C906	36824102	Styrol 50WV 1000PF			
C909, 911	36326685	Tantalum 20WV 6.8µF			
C909, 911 C914~941	32821102	Feed thru 50WV 0.001µF			
C914~941	34220107	Electrolytic 16WV TW 100µF			
	34220107	Electrony tie Tow v Tw Toom			-
TO 0.1	55000000	TRANSFORMER	<b>\</b>		
T901	55003084	7MC-312162NO #220188			
		INDUCTOR			
L901, 902	55003069	#220012			
Pool	(=44000)	MINI CONNECTOR			
J904	67110004 68150007	<b>5048-11A</b> 5047-15 #240061			
with wire			-		
J905	68150008	5047-15 #240062			
with wire	-				
	-				

# WORLD TIME CONVERSION CHART IN HOURS

Philippines. Perth,	8AM	9AM	10AM	14M	Noon	1PM	2PM	ЗРМ	4PM	<b>5PM</b>	<b>6PM</b>	7 P.M	8PM	9PM	10PM	11PM	Mid Night	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM
Sumatra. Thailand, Laos.	7 AM	8AM	9AM1	0 AM1	1 AM	loon	1 PM	2PM	3PM	4 P M	<b>5PM</b>	6PM	<b>7PM</b>	<b>8PM</b>	Md6	MIOD	1PM	Mid	1 AM	2AM	3 A M	4 AM	5 AM	6AM
Calcutta, Novosi birsk Russia, Tibet.	6AM	7 AM	8AM	9AM1	10AM1	1 1 AMN	Noon	1 PM	2PM	3PM	4PM	5 P.M	<b>6PM</b>	<b>7PM</b>	<b>8PM</b>	9PM1	OPM1	11PM	Mid Night	1 AM	2AM	3AM	4AM	5AM
Central Russia, Bombay, India.	5AM	6AM	7 AM	8AM	9AM1	OAM1	1 AM	Noon	1 P M	2PM	3PM	4PM	<b>5PM</b>	<b>ВРМ</b>	7 P.M	8PM	9PM	10PM	1 1 PM	Mid Night	1 AM	2AM	3AM	4AM
Mauritius, Iran. Reunion Island.	4AM	5 AM	6AM	7 AM	8AM	9AM	10AM1	11 AM	Noon	PM	2PM	зРМ	4PM	<b>5PM</b>	6РМ	7PM	8PM	9PM	10PM	1 1 PM	Mid Night	1 AM	2AM	3AM
Arabia, Armenia, Ethiopia, Madagas car	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1PM	2PM	ЗРМ	4PM	<b>5PM</b>	<b>6PM</b>	7PM	8PM	9PM	10PM	1 1 PM	Mid	1 AM	2AM
Eastern Europe.At hens, Cape Town. Cairo. Moscow	2AM	3AM	4AM	5 AM	6AM	7 AM	8AM	9AM	10AM	11AM	Noon	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	Mid Night	1 AM
Central Europe. Berlin, Geneva, Stockholm, Vienna	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	114M	Noon	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	Mid
тмъ	0000	0100	0200	0300	0400	0200	0090	0010	0800	0060	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Iceland. Canary Islands.	11PM	Night	_	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10 A M	11AM	Noon	1PM	2PM	3PM	4PM	5PM	6РМ	7PM	8PM	9PM	10PM
8910sA	10PM	11PM	Mid	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM
Greenland. Rio de Janeiro. Brazil	9РМ	10PM	1 1 PM	Mid	1 AM	2AM	3AM	4 AM	5 AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1 PM	2PM	3PM	4PM	<b>5PM</b>	6PM	7PM	8PM
Atlantic Standard Time. Argentina. Nova Scotia.	8PM	Md6	10PM	11PM	Mid	1 AM	2AM	3AM	4 AM	5 AM	6AM	7 AM	8AM	9AM	10AM	11AM	Noon	1 PM	2PM	зРМ	4PM	5PM	6PM	7PM
Eastern Standard Time, Montreal, New York, Peru.	7PM	8PM	MH6	10PM	1 1 PM	Mid	1 AM	2AM	3AM	4 AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1 P.M	2PM	3PM	4PM	5PM	6PM
Central Standard Time. Chicago, Costa Rica.	<b>6PM</b>	7PM	8PM	MH6	10PM	1 1 PM	Mid	1 AM	2AM	3AM	4 AM	5 AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1 P.M	2PM	3PM	4PM	5PM
Mountain Standard Time, Calgary, Denver, Phoenix.	5PM	6PM	7PM	8PM	9PM	10PM	11PM	Mid	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1PM	2PM	3PM	4PM
Pacific Standard Time: Los Angeles Seattle, Juneau.	4PM	5PM	<b>6PM</b>	7PM	8PM	M46	10PM	11PM	Mid	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1 PM	2PM	3PM
Eastern Alaska. Dawson	ЗРМ	4PM	5PM	6PM	7PM	8PM	9PM	OPM	11PM	Might	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM	9AM	10AM	1 1 AM	Noon	1PM	2PM
Hawaii. Shaalal yawbiM.	2PM	ЗРМ	4PM	5PM	6PM	7PM	8PM	9PM1	10PM	11PM	Mid	1 AM	2AM	3AM	4AM	5 AM	6AM	7 AM	8AM	9AM1	9AM10AM1	OAM 1 1 AM N	Noon	1 PM
Nome, Alaska. Samoa Islands.	1 P M	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	Mid Night	1 AM	2AM	3AM	4AM	5 AM	6AM	7 AM	8AM		-	1 1 AM	Noon
International Date Line. Fiji Islands.	Noon	1PM	2PM	ЗРМ	4PM	5PM	6PM	7PM	8PM	9PM	9PM10PM11PM	1 1 P.M	Mid	1 AM	2AM	3AM	4AM	5 AM	6AM	7AM	8AM	9AM	9AM10AM	9AM10AM11AMN
New Caledonia. New Zealand.	1 1 AM	Noon	1PM	2PM	ЗРМ	4PM	5PM	6РМ	7PM	8PM		10PM	11PM	Mid	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM		10AM
Eastern Australia Melbourne, Sydney.	9AM10AM	OAM11AM	1 AM Noon	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM11PM	11PM	Mid Night	1 AM	2AM	3AM	4AM	5 AM	6AM	7 AM	8AM	
Japan	9AM	OAM	1 AM	loon	1 P.M	2PM	3PM	4PM	5PM	6РМ	7 P.M	8PM	MH6	OPM	1PM	Mid Night	1 AM	2AM	3AM	4AM	5AM	6AM	7 AM	8AM

