

FDK

INSTRUCTION MANUAL



MULTI-2700

**144 MHz
FM/SSB/CW/AM
10 W / 1 W
VFO/SYNTHESIZED
TRANSCEIVER**

FUKUYAMA

ELECTRONICS CO., LTD.

CONTENTS

| | |
|--------------------------------------|----|
| Features of MULTI-2700 | 1 |
| Specifications | 2 |
| Names of Parts and Description | 3 |
| Precautions | 6 |
| Accessories | 6 |
| Connections | 7 |
| Operation | 8 |
| OSCAR Communication | 12 |
| Internal View Location | 14 |
| Circuit Operation | 15 |
| Block Diagram | 17 |
| Troubleshooting | 18 |
| Schematic Diagram | |

FEATURES OF MULTI-2700

The MULTI-2700 is a 144MHz band, all-mode transceiver of the highest class developed by Fukuyama Electronics, a specialized manufacturer of ham equipment, from the latest electronics technology. Capable of Oscar communication, the MULTI-2700 offers the ultimate versatility for every radio operator from beginner to veteran as an unsurpassed 144MHz transceiver.

■ **All solid state, multi-mode (USB-LSB, FM (wide and narrow), CW, AM) 2m transceiver:**

The MULTI-2700 is a completely solid state, 2m band, all-mode transceiver employing many state of the art semiconductors, ICs and FETs.

■ **Employs a phase-locked loop synthesizer for transmitting and receiving on 600 channels at intervals of 10kHz; a VXO variable up to ± 7 kHz and a VFO for continuous coverage from 144MHz to 148MHz:**

The digital phase-locked loop synthesizer (with LED display) permits transmission and reception on 600 channels from 144MHz upward at intervals of 10kHz with exceptional stability. With a VXO variable up to ± 7 kHz, the unit can continuously cover the frequency range from 144 to 148MHz.

VXO operates only when operating the digital synthesizer, but not in VFO operation.

■ **FM narrow-wide selector switch:**

With an FM band narrow-wide selector switch on the front panel, the narrow or wide mode can be easily selected as desired.

■ **Powerful noise blanker (NB) built in:**

The newly designed noise blanker is especially effective for eliminating pulse noises, such as generated by automobiles, for noise-free transmission and reception. The noise blanker operates on SSB, CW and AM, but not on FM position.

■ **Two meters, one FM center meter and an S-meter for FM, SSB, CW and AM:**

The meter for FM, SSB, CW and AM works as an S-meter in receiving, and as an RF meter (output meter) in transmission. The FM center meter can be accurately tuned to the center frequency of the received signal in FM reception with the RIT knob.

The RIT knob can vary the receiving frequency about ± 3.5 kHz without changing the transmitting frequency.

■ **Accurate VFO mechanism:**

A newly developed dual-speed dial mechanism consists of an inner main knob, whose one turn corresponds to 20kHz, and an outer knob, whose one turn corresponds to 100kHz (their gear ratio being 5 to 1). This is combined with the VFO to produce utmost stability and allows maximum ease of fine adjustment in SSB and CW reception. Even the beginner will find tuning very easier.

■ **Outstanding accessory circuits:**

VOX (voice operation control) circuit, microphone compressor amplifier, CW monitor, AGC (fast-slow) knob, FM and SSB microphone gain controls allow the maximum individual tailoring of operational transceiver characteristics.

In addition, a headphone jack, a 7-pin connector for a booster, a cooling fan mounting hole, and a leather handle are provided.

■ **Microphone compressor:**

A compressor ON-OFF switch is located inside the top access hatch. When this switch is turned ON during SSB transmission, the average talk power will be more than 3-4 times increases, which is efficient DX communication.

■ **Balanced mixer:**

A heterodyne balanced mixer employing a field effect transistor FET (3SK40) is used for improved spurious elimination during transmission on SSB.

■ **Top access hatch:**

The top box on the left contains the microphone compressor ON-OFF switch, VOX gain control, SSB microphone gain control, FM microphone gain control, and other switches.

It is a very convenient location as these controls and switches can be used whenever necessary.

■ **A receiving preamp can be built in. (Optional)**

■ **Oscar communication is possible through the 29MHz integrated receiver.**

■ **Easy-to-use semi-breakin key operation.**

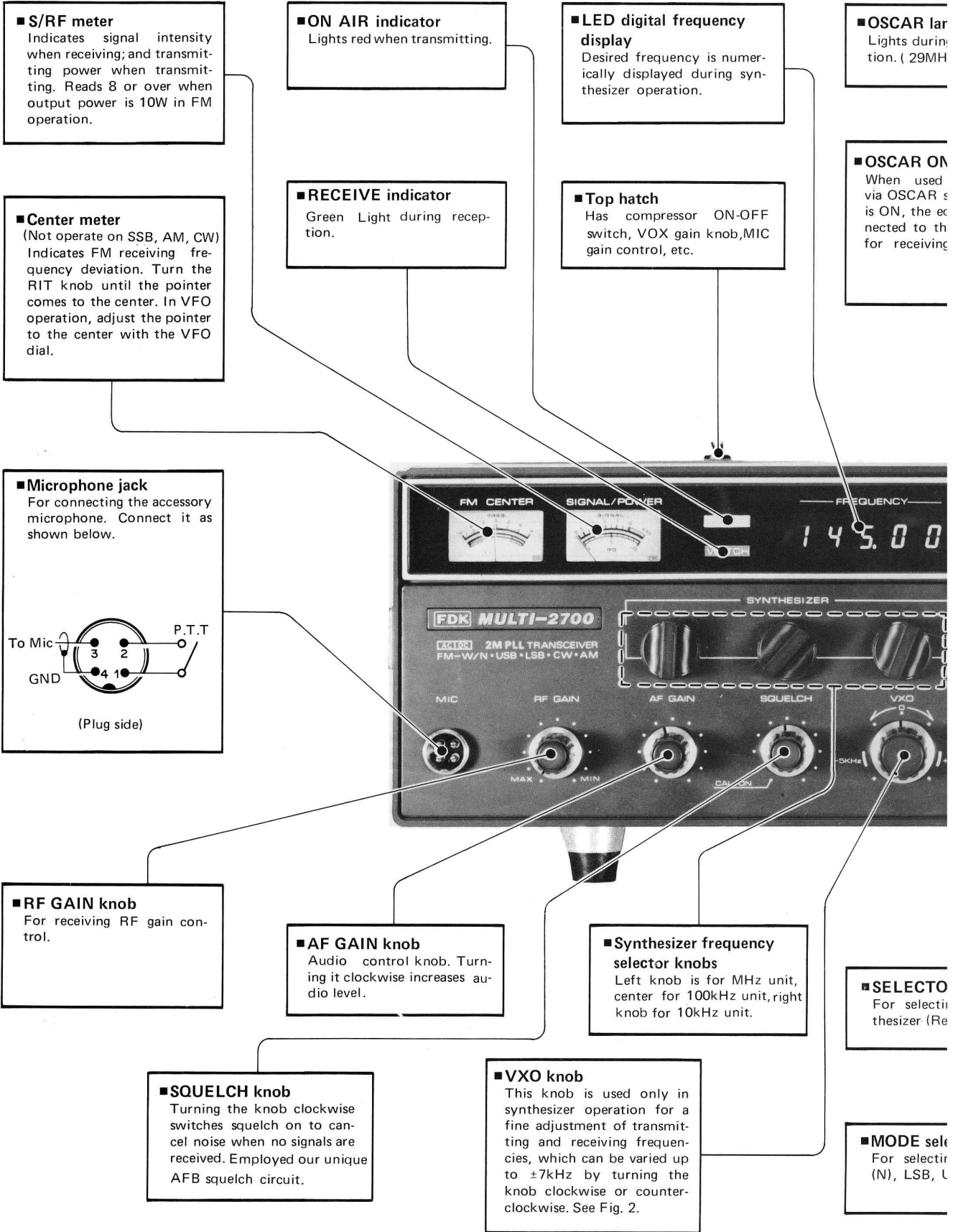
■ **Headphone jack provided:**

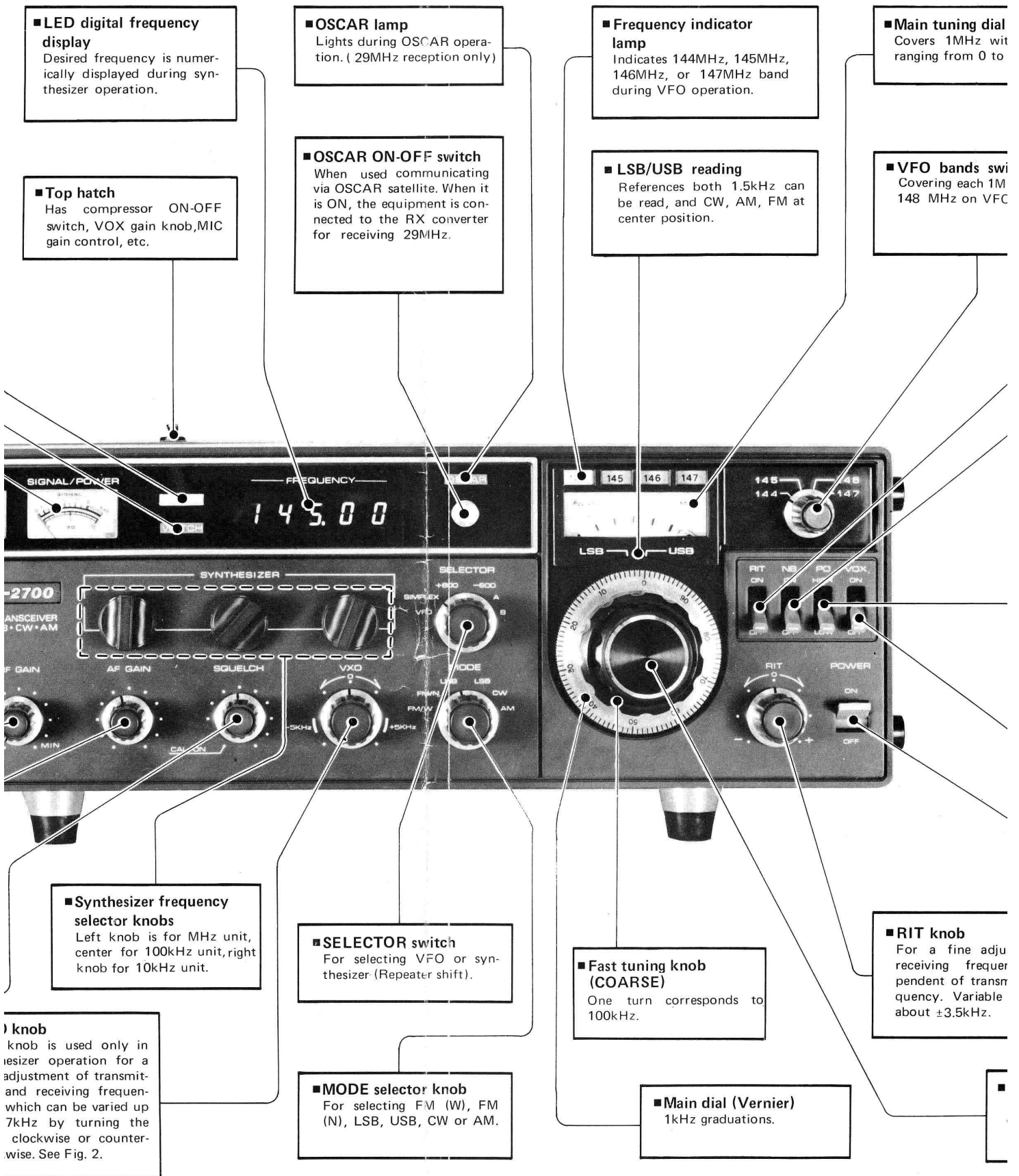
A headphone can be plugged into the headphone jack in the rear panel. Output impedance is 8 ohms.

SPECIFICATIONS

| Mode | FM-N (F3) | FM-W (F3) | USB, LSB (A3J) | CW (A1) | AM (A3H) | |
|-----------------------------|---|---------------------------------------|---|------------------|---------------------------------------|----|
| Frequency range | 143 to 149MHz (600 channels from 143.00MHz up at 10kHz intervals) synthesized; VXO variable by more than ± 7 kHz offers continuous coverage of frequency, range from 144MHz to 148MHz; built-in VFO. | | | | | |
| Power output | High | 10W | | 10W (PEP) | 10W | 3W |
| | Low | 1W | | 1W (PEP) | 1W | 1W |
| Modulation | Variable reactance frequency modulation | | Balanced modulation | — | Low-power modulation | |
| Max. frequency deviation | ± 15 kHz | ± 5 kHz | | | | |
| IF interference ratio | More than 60dB | | | | | |
| Carrier suppression ratio | More than 40dB | | | | | |
| Side-band suppression ratio | More than 40dB | | | | More than 40dB | |
| Spurious radiation level | Less than -60 dB | | | | | |
| Antenna impedance | 50 ohm | | | | | |
| Microphone impedance | 500 ohm (avariable 500 – 600 ohm) | | | | | |
| Squelch sensitivity | -6 dB | | | | | |
| Receiving system | Double superheterodyne | | Single superheterodyne | | | |
| Receiving sensitivity | S/N more than 34dB for 1μ V input | S/N more than 26dB for 1μ V input | S/N more than 10dB for 0.5μ V input | | S/N more than 10dB for 2μ V input | |
| Frequency stability (VFO) | Less than ± 2 kHz against temperature change within range of -10° C to $+60^{\circ}$ C; less than ± 2 kHz from 1 to 30 minutes after power is switched ON at normal temperature; less than 200Hz per 30 minutes thereafter. | | | | | |
| IF frequency | 1st IF 16.9MHz, 2nd IF 455kHz | | 16.9MHz | | | |
| Image ratio | More than 60dB | | | | | |
| Selectivity | -6 dB | More than 20kHz | More than 12kHz | More than 2.4kHz | | |
| | -60 dB | Less than 40kHz | Less than 24kHz | Less than 4.8kHz | | |
| Audio output and impedance | More than 2W at 8 ohm. (8 ohm 10% distortion) | | | | | |
| Power consumption | Max. at transmission: 110VA at AC117V 4A at DC13.8V At no signal reception: 40VA at AC117V 1.1A at DC13.8V | | | | | |
| Power source | The rated voltage and frequency for Model MULTI-2700 correspond to the main's voltage and frequency used in the country to which they are shipped. (The rated voltage and frequency are shown on the rating label on the set.) If it is necessary to alter the rated voltage and/or the rated frequency, contact your FUKUYAMA dealer. | | | | | |
| Size | 128(H) x 378(W) x 305(D) (m/m) | | | | | |
| Weight | Approx. 14kg | | | | | |

NAMES OF PARTS AND DESCRIPTION





■ **LED digital frequency display**
Desired frequency is numerically displayed during synthesizer operation.

■ **OSCAR lamp**
Lights during OSCAR operation. (29MHz reception only)

■ **Frequency indicator lamp**
Indicates 144MHz, 145MHz, 146MHz, or 147MHz band during VFO operation.

■ **Main tuning dial**
Covers 1MHz with ranging from 0 to

■ **Top hatch**
Has compressor ON-OFF switch, VOX gain knob, MIC gain control, etc.

■ **OSCAR ON-OFF switch**
When used communicating via OSCAR satellite. When it is ON, the equipment is connected to the RX converter for receiving 29MHz.

■ **LSB/USB reading**
References both 1.5kHz can be read, and CW, AM, FM at center position.

■ **VFO bands switch**
Covering each 1M 148 MHz on VFC

■ **Synthesizer frequency selector knobs**
Left knob is for MHz unit, center for 100kHz unit, right knob for 10kHz unit.

■ **SELECTOR switch**
For selecting VFO or synthesizer (Repeater shift).

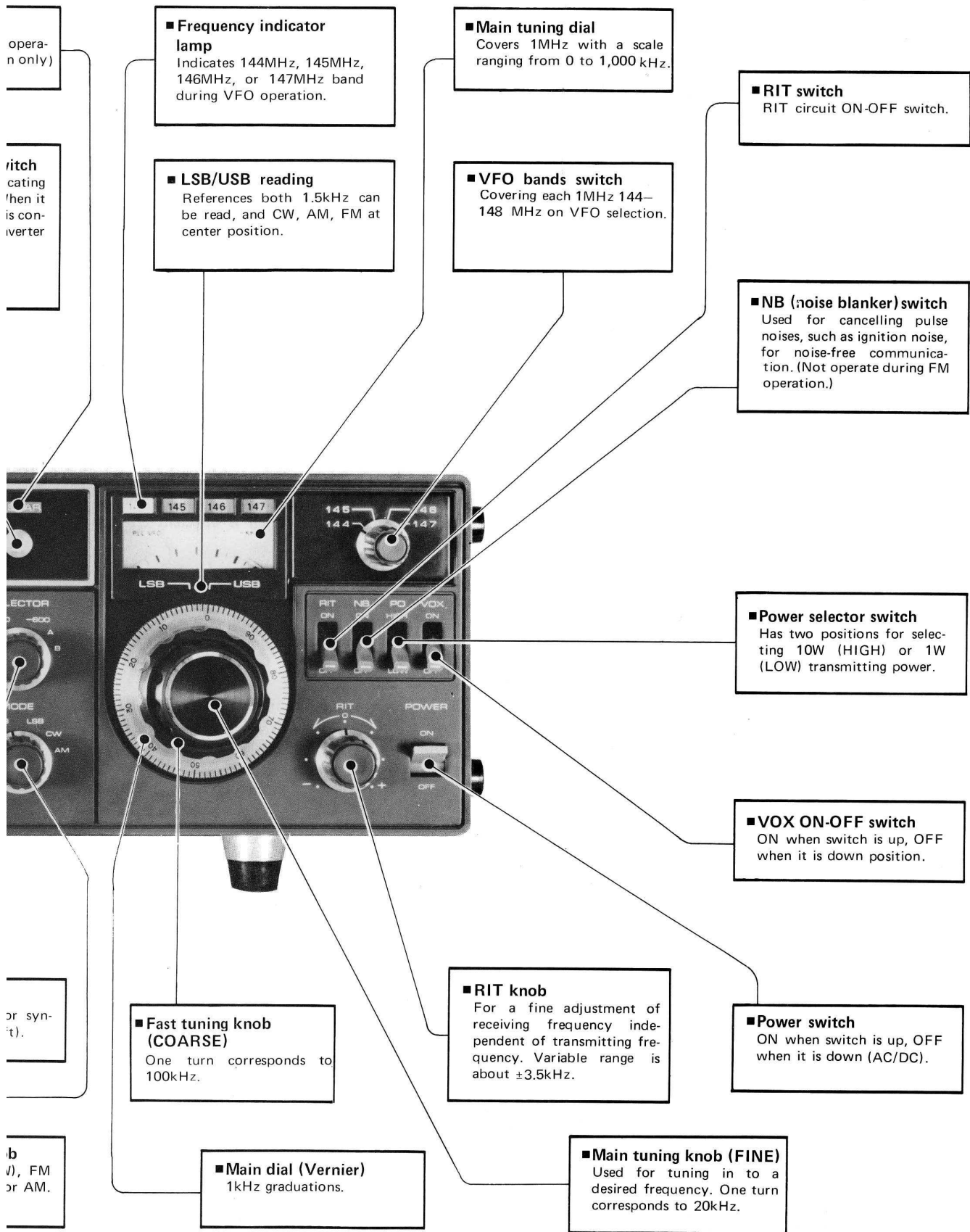
■ **Fast tuning knob (COARSE)**
One turn corresponds to 100kHz.

■ **RIT knob**
For a fine adjustment of receiving frequency. Variable about ± 3.5 kHz.

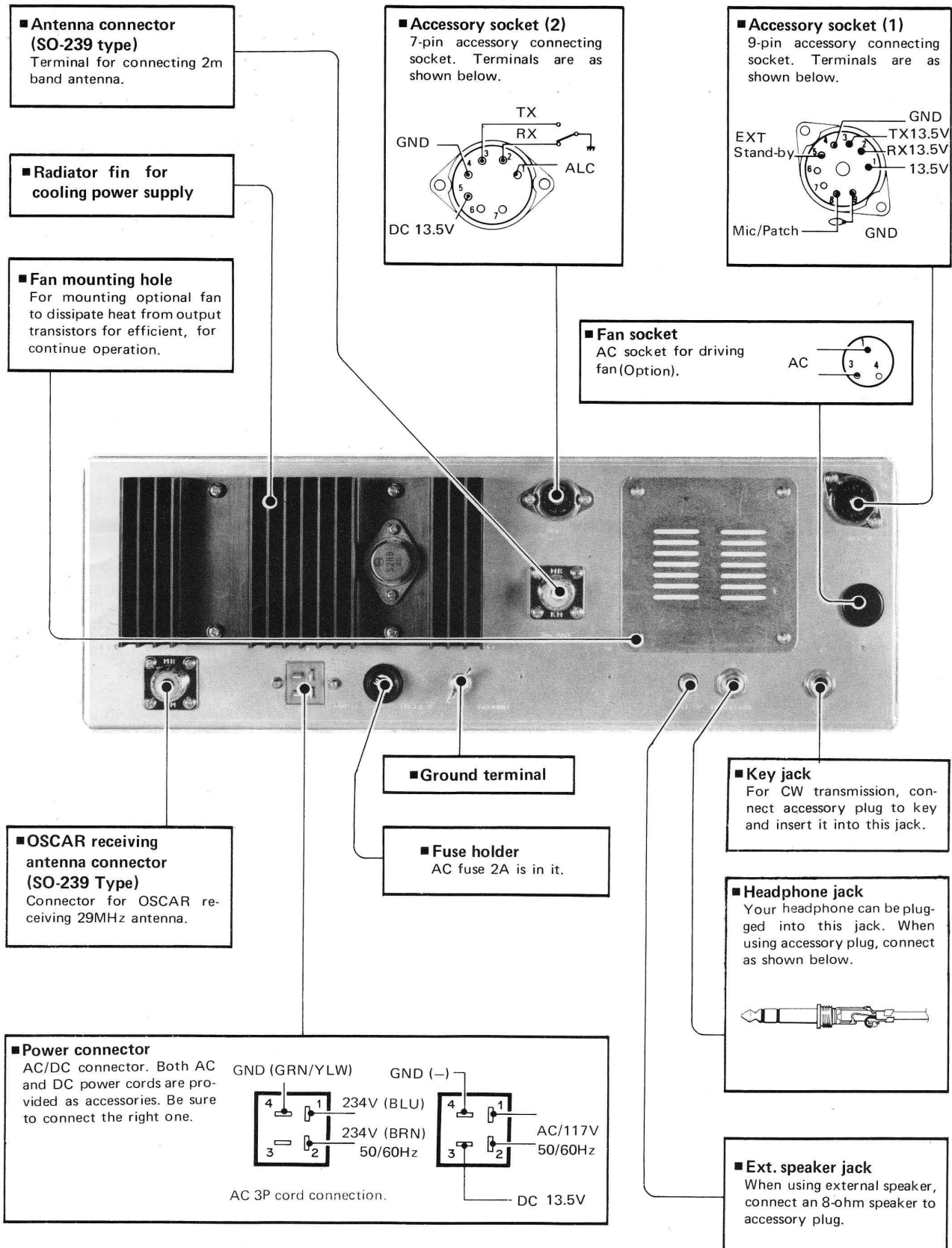
■ **Mode selector knob**
For selecting FM (W), FM (N), LSB, USB, CW or AM.

■ **MODE selector knob**
For selecting FM (W), FM (N), LSB, USB, CW or AM.

■ **Main dial (Vernier)**
1kHz graduations.



NAMES OF PARTS AND DESCRIPTION



PRECAUTIONS

The MULTI-2700 is designed for safe operation, but be sure to observe the following instructions for trouble free, enjoyable operation.

- Do not transmit without connecting an antenna.
- Be very careful about the power supply polarities. Do not mistake the AC cord for the DC cord or vice versa.
- Do not connect or disconnect the power cord when the power switch is in the ON position.
- Use the 5A fuse in the fuse holder on the DC cord when operating on DC; or the 2A fuse in the fuse holder in the rear when operating on AC.
- The MULTI-2700 possible to transmission for a long time, but it is suggested that continuous transmission not longer than 30 minutes be avoided as much as possible.
- All the cores and trimmers inside have already been adjusted, and therefore should not require adjustment.
- If the synthesizer cannot be locked, turn the power switch OFF, wait for 4 to 5 seconds, and then turn it ON again.
- Make sure that the SELECTOR switch and the MODE selector switch are in the correct positions. Also check the RIT knob and VXO knob to see that they are also in the correct positions.

ACCESSORIES

The MULTI-2700 has the following accessories. Please check that you have all of them.

| | |
|---|--------|
| Instruction manual | 1 |
| AC power cord (with connector) | 1 |
| DC power cord (with connector and fuse) | 1 |
| Key plug | 1 |
| Spare fuse (AC 2A, DC 5A) | 1 each |
| Dynamic microphone (with connector) | 1 |
| 9P accessory plug | 1 |
| 7P booster plug | 1 |
| 3P fan plug | 1 |
| Headphone plug | 1 |
| EXT SP plug | 1 |

CONNECTIONS

1. Location

Avoid using the MULTI-2700 in a hot, humid, dusty place.

An airy, dry place is ideal for its operation. Avoid operating your MULTI-2700 in direct sun light. You need not be too nervous about it, but see that the bottom or the back of your MULTI-2700 is not too close to a table or a wall.

2. Connecting to a power supply

The MULTI-2700 operates on an AC117V to 240V power supply or a DC13.8V power supply. (Refer to SPECIFICATIONS.)

When changing one kind of power supply to the other, you need only change the accessory power cords. The two-color (red and black) cord is for DC. Each of the power cords need only be inserted into the power socket in the back. When changing the AC cord to the DC cord or vice versa, be sure to confirm the following beforehand.

- (1) Turn the power switch on the front of the set to the OFF position and the PTT switch on the microphone to the receiving position.
- (2) Disconnect the power cord in use from the AC socket or a battery, and change it with the other. (This is necessary for preventing the set from breaking down and protecting yourself from electric shock.)
- (3) The 4-pin square socket on the AC or DC cord has a stopper. When plugging the cord into the set, press the stopper with your fingers and pinch it securely with the stopper clamp on the set. When pulling it out, press the stopper with your fingers again and pull it out.

3. Antenna Connection

A high-performance antenna is essential to efficient, enjoyable communication.

No matter how excellent a transceiver may be, it cannot deliver full performance with a poor antenna. To assure full performance as a fixed station, install a ground plane (GP) or multiple-element antenna about 10 to 15 meters high, and connect it to the set at its antenna connector (PL-259 type) with high quality, 50-ohm coaxial cable.

The set has an output impedance of 50 ohms, so be sure to use an RG-58, RG-8AU or equivalent coaxial cable.

Generally, a vertical antenna is used for FM reception on the 144MHz band; and a horizontal antenna is mainly used for reception on SSB. Take this into consideration when erecting an antenna.

The case of SSB, a crossed Yagi antenna seems advantageous because it is effective for both vertical and horizontal polarized waves.

A multiple-element, directional, efficient Yagi antenna is recommended for DX (long-distance) communication or communication with a specific party. A GP antenna is recommended this case of communicating with an unspecific local (near) station.

4. Microphone

Plug the accessory microphone into the MIC connector in the front panel of the set, and turn the nut to lock it. In case of using any other microphone, use one with an impedance of 500 to 600 ohms. In that case, check against the microphone connection diagram on Page 3 if the connector plug can be connected as shown.

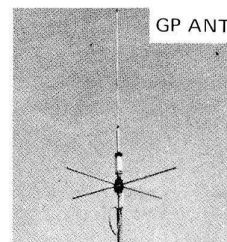
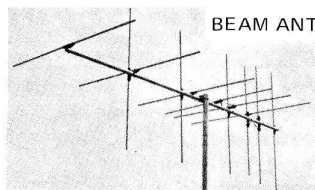
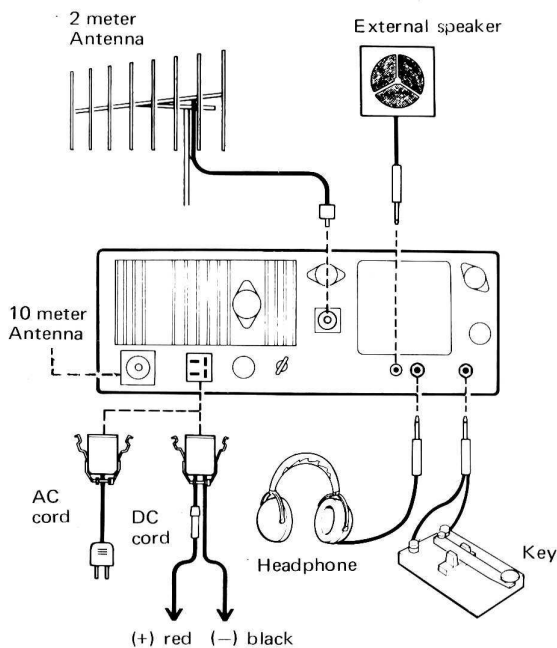
5. External Speaker and Headphone

A case of using an external speaker or a headphone, make sure that it has an impedance of 8 to 16 ohms. Use the correct accessory plug and insert it into the jack in the back panel for connection. The larger jack is for a headphone; and the smaller one for a speaker (or attenuated to recordings).

6. Key

Transmitting and receiving CW (A1) signals, connect the accessory plug to the key, and insert it into the KEY jack in the rear panel.

Connections on the Rear panel



OPERATION

Synthesizer Operation (VFO not operate)

1. SSB

Before switching the power on, connect the correct antenna to the antenna connector in the rear of the set, plug the accessory AC cord into the back socket, and then into the AC socket. For SSB reception, the controls on the front panel of the set must be preset as shown in the table below.

| | |
|---------------------------|---|
| POWER switch | OFF |
| RF GAIN knob | Turn counterclockwise fully. |
| AF GAIN knob | Turn counterclockwise fully. |
| SQUELCH knob | Does not operate. If this knob is turned counterclockwise fully, CAL SW (calibration switch) will be ON. |
| VXO knob | 0 |
| MODE switch | USB* |
| SELECTOR switch | SIMPLEX |
| OSCAR switch | OFF |
| VFO dial | Does not operate. |
| RIT knob | 0 |
| RIT switch | OFF |
| NB switch | OFF |
| PO switch | HI or LOW |
| VOX switch | OFF |
| Frequency selector switch | Does not operate. |

* The set can transmit and receive in two modes, i.e., USB and LSB, But be sure to turn the MODE selector to the USB position because it is a matter of practice to use USB on the 144MHz.

After all receiving preparations are done, turn the power switch ON. Now, the set is ready for SSB reception. The center meter, S/RF meter and RECEIVE lamp in the upper left part of the front panel light, and the light emission diodes in the center top indicate a frequency.

Turn the three SYNTHESIZER knobs to the desired receiving frequency until it is displayed. (See Fig. 1.)

It shows that the set has started operation. Since the set is all solid state in construction, it starts operating moment the set is switched ON.

As the AF GAIN knob is slowly turned clockwise, you will hear noise or signals. Set the knob to the best position.

When receiving an SSB station, make sure it is sending signals on a frequency that can be received well. An SSB station operating on a distant frequency cannot be received.

The 144MHz band can be covered from end to end with the 10kHz SYNTHESIZER knob (the right one) and

the VXO knob. For example, turn the SYNTHESIZER knob 144.15 and then turn the VXO knob clockwise or counterclockwise so that 144.143 to 144.157MHz can be continuously covered.

In SSB reception, the voice of the talking party changes with how the set is tuned in to. Make a fine adjustment with the VXO knob until the voice of the talking party can be heard clearest. Now the set has been tuned in to the talking party.

In case ignition noise (pulse noise) is generated by an automobile, etc., turn the NB (noise blanker) switch ON so that the noise will be suppressed to allow even feeble signals to be heard clearly.

When receiving a near station, for example, voice may become distorted due to too great signal intensity. In that case, turn the RF GAIN knob to an appropriate position.

Fig.1 Indicates 144.480MHz

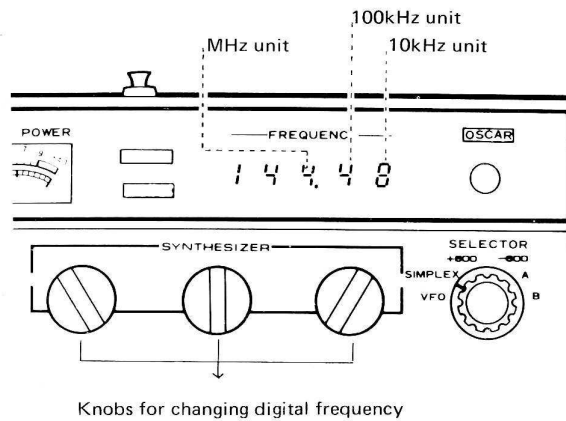
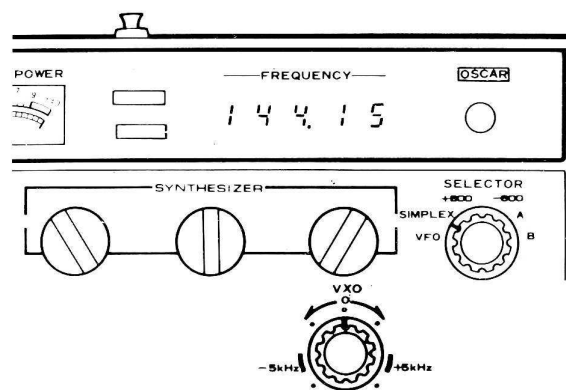


Fig. 2 Digital frequency display vs VXO



When VXO knob is turned clockwise fully, transmitting and receiving frequencies will be $144.150 + 0.007 = 144.157(\text{MHz})$.

When VXO knob is turned counterclockwise fully, transmitting and receiving frequencies will be $144.150 - 0.007 = 144.143(\text{MHz})$.

Frequency can be varied up to $\pm 7\text{kHz}$ with VXO.

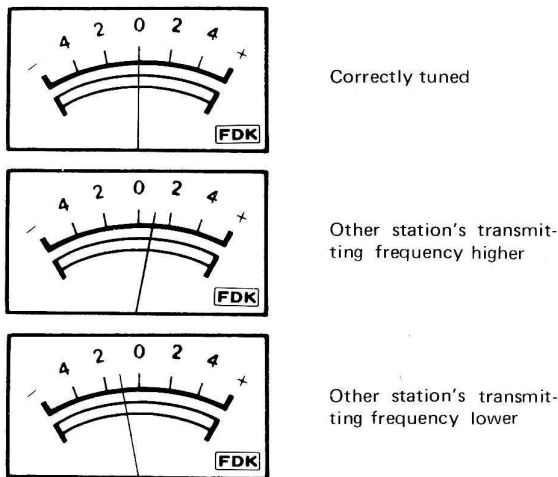
2. CW, AM

For CW reception, turn the MODE selector to the CW position so CW can be received in the same way as SSB. For AM reception, tune the set in until the S-meter reads greatest.

3. FM

- Turn the MODE selector to FM (W) or FM (N). Other than this, preset the controls on the front panel to the same positions as mentioned for SSB. There are two FM modes, i.e., 40kHz-separation FM wide and 20kHz-separation FM narrow. Either FM (W) or FM (N) can be easily selected with the MODE selector on the front panel.
- Turn the power switch ON, and turn the three SYNTH knobs until your desired frequency is digitally indicated.
- If there are no signals on the selected receiving frequency, plain noise can be heard. In such a case, turn the SQUELCH knob clockwise until the noise is erased. Do not turn the knob beyond the point where the noise is erased because it will also block weak signals.
- Noise will be blanked by signals coming in from a ham station. Turn the AF GAIN knob to an acceptable volume level.
- If the pointer of the center meter at left moves to either the right or left during receiving, it indicates that the received signal frequency is off. Turn the RIT switch ON, turn the RIT knob until the center meter pointer comes back to the center, which represents the correct tuning point. Now the voice can be heard more clearly than before. Fig. 3 shows the center meter vs frequency. When the center meter is at the center, the S-meter reads greatest.

Fig. 3 Center meter indication vs receiving tuning point



Turn the RIT knob until the center meter needle comes to the 0 position.

**VFO OPERATION
(Synthesizer not operate)**

1. SSB

For operation on SSB, preset the controls on the front panel as shown below.

| | |
|---------------------------|-------------------------------|
| POWER switch | OFF |
| RF GAIN knob | Turn counter clockwise fully. |
| AF GAIN knob | Turn counterclockwise fully. |
| SQUELCH knob | Does not operate. |
| VXO knob | Does not operate. |
| MODE switch | USB* |
| SELECTOR switch | VFO |
| OSCAR switch | OFF |
| RIT knob | 0 |
| RIT switch | OFF |
| NB switch | OFF |
| PO switch | HI or LOW |
| VOX switch | OFF |
| Frequency selector switch | 144 |

* In SSB reception, the S-meter has no point of stability.

- Connect the correct antenna to the set, and turn the power switch ON. The second meter lamp, RECEIVE lamp, dial and the 144 indicator lamp over the dial will light.
- Turn the VFO dial knob to the frequency used by an SSB station so a ham station can be received. As in the case of using the synthesizer, slowly turn the dial knob until the other station's voice can be heard clearest. SSB reception requires some experience and technique when using VFO. You will get used to it step by step. The point is where the other station received clearly, where to set will tuned exactly.

2. CW, AM

Turn the MODE switch to CW, turn the VFO dial knob as in SSB reception until the correct tuning is obtained. In AM reception, turn the MODE switch to AM, and tune the set in until the S-meter reads greatest.

3. FM

When receiving on the 144MHz band, turn the frequency selector switch to 144MHz. When receiving on the 145MHz band, turn the same to 145MHz. The 144 or 145 indicator lamp will light depending on the frequency selected. The receiving method is the same as in the case of using the synthesizer. But do not forget to turn the MODE switch to FM (WIDE) or FM (NARROW). Turn the VFO knob slowly until the meter reads greatest to indicate the correct tuning in to the other station.

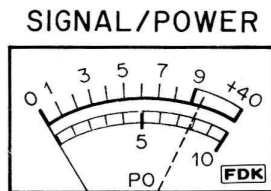
Transmission

The transmitting method is the same with the synthesizer and VFO. It is important to tune in the set exactly to the other station. Connect the microphone and an antenna properly.

1. SSB, CW

Adjust the set to your desired frequency, turn the MODE selector switch to CW, push the PTT switch on the microphone to make it ready for sending (transmission). At this instant, the ON AIR lamp lights. If the S/RF meter (output meter) reads 7 or 8 (high power), signals are properly being transmitted. If the meter reads less than that, stop transmission. The cause is possibly an antenna mismatch. Check the feed line or the M-type (PL-259) connector. If the meter pointer stays at the 0 point, the cause is either a broken feed line or a disconnected antenna. First, check the antenna system. If the RF (output) meter indicates a normal value, set the MODE selector switch to USB, press the PTT switch on the microphone and start transmission. (Since the MODE selector switch is turned to USB, the ON AIR lamp lights, but the RF meter pointer stays still.) Speak into the microphone and the RF meter pointer will move up to 7 or 8 maximum. If no sound input enters the microphone in SSB transmission, the RF meter pointer remains still at 0, which is normal.

Fig. 4 Difference in RF meter indications between SSB and FM



In SSB transmission, the meter pointer remains still unless you speak into the microphone. In FM transmission, the meter reads approx 8.

Once communication has started, do not touch the dials and VXO knob except when changing the transmitting frequency. If it becomes difficult to hear the other party due to a frequency deviation, turn the RIT switch ON and turn the RIT knob to adjust only the receiving frequency to the other station.

In CW transmission, set the MODE selector switch to CW, connect the key to the KEY jack of the rear, and enjoy CW operation. Side tone will work during CW operation.

2. FM, AM

Set the MODE selector switch to FM (W), and select a desired frequency. Push the PTT switch on the microphone, and it is ready for transmission as indicated by the lighting of the ON AIR lamp. The RF (output) meter reads 8 or over when LOW transmitting power is selected. Different from SSB transmission, the RF meter pointer remains at 8 or over in FM transmission.

If the RF meter reads far less than that, check the antenna system in the same way as in SSB transmission because the trouble cause is likely to be in it. If the RF meter reads 8 or over, you can start talking with the other party. In case of QSO with a local station, LOW output power is sufficient.

When the 20kHz separation FM (narrow) mode is desired, turn the MODE selector switch to FM (N), so that you can make more effective use of the narrow FM band selected. If FM (N) is selected, your party should be select the same FM (N) mode.

For AM operation, you need only set the MODE selector switch to AM.

How to use VOX

When the VOX switch is turned ON, transmission and receiving standby will be automatically changed over by sound without depressing the PTT switch on the microphone. VOX sensitivity can be adjusted by removing the cover on the top of the hatch and turning the VOX GAIN knob. Then, in receiving condition, operate VOX and adjust the ANTI-TRIP knob so VOX will not be erratically driven by sounds from the speaker.

If the ANTI TRIP knob is turned clockwise excessively, the VOX circuit may be driven by noise, etc., making it impossible for you to proceed to transmission. Exercise care when adjusting this knob. Return time to reception can be adjusted with the DELAY knob.

How to use RIT and VXO

The receiving frequency can be varied up to ± 3.5 kHz from the preset value by turning the RIT knob. Turning this knob does not affect transmitting frequency.

The VXO knob can vary both transmitting and receiving frequencies simultaneously up to ± 7 kHz from the frequency indicated by the synthesizer. In this case, the RIT knob must be at 0. If your talking party demands a change in transmitting frequency, turn the VXO knob to adjust the transmitting frequency if the synthesizer is in operation; or turn the VFO knob if VFO is in operation. In both cases, do the final receive frequency touchup by turning the RIT knob.

OPERATION

Frequency Calibration (RIT OFF)

Dial calibration is necessary for the correct frequency reading. For calibration purposes, use the built-in 100kHz marker oscillator.

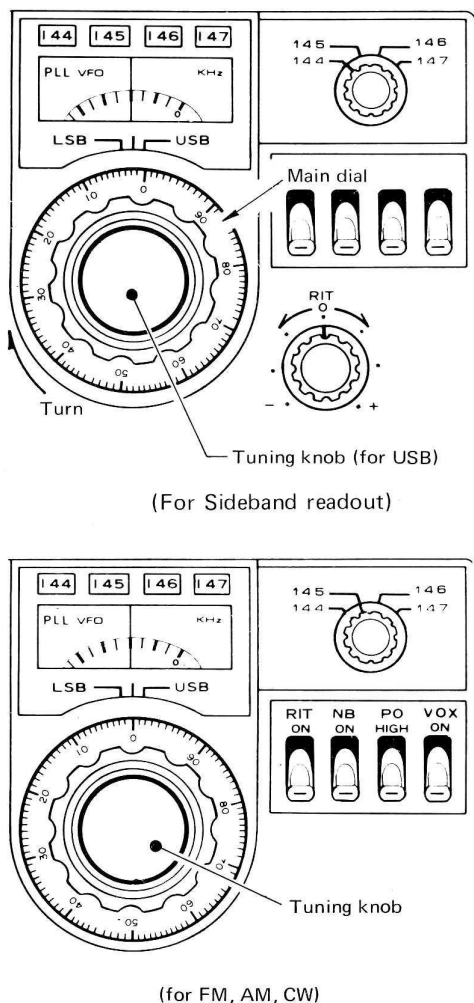
When the SQUELCH knob is turned counterclockwise fully (until it clicks), the CAL (calibration) switch is closed to operate the marker oscillator.

Marker signals are generated every 100kHz. The correct marker beat can be received every 100 divisions from 0 to 1,000 on the subdial for frequency calibration or synthesizer 100kHz unit.

Read for USB (set the MODE selector switch to USB.)

As the main dial knob is turned clockwise, the beat changes from treble to bass. Stop the subdial knob at a point where the beat ceases, and adjust the 0 degree on the main dial to the USB dial gauge by holding the main dial knob, which is pressed against the main dial by a spring, and sliding the main dial until its 0 degree is adjusted to the USB dial gauge. (Fig. 5)

Fig. 5 Frequency Readout (VXO to 0 RIT to OFF)



Read for LSB

This case, transmitting frequency is 1kHz lower than that for LSB. If dial calibration is necessary in the CW mode, adjust the 0 degree on the main dial to the center of the dial gauge at the point 1kHz below.

As the FM and AM

Zero beat cannot be obtained from marker signals. The point where the S-meter reads greatest when signals are received indicates a tuned-in frequency. As in the case of CW, read the frequency from the center dial gauge.

How to Read VFO Frequency (RIT OFF)

Operating frequency can be correctly read by means of the VFO dials.

The dial mechanism consists of the main dial, subdial, dial gauge, main tuning knob and fast tuning knob. (See page 4 for operational description.)

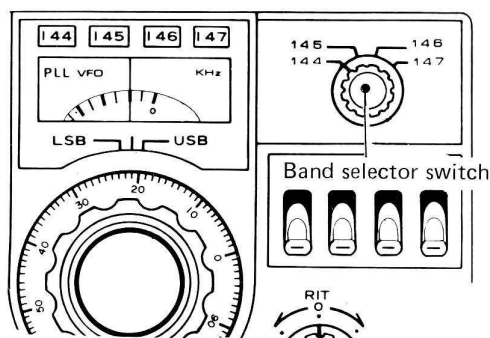
In SSB operation, it is necessary to read frequencies in units as small as 1kHz. Use the main dial for this purpose.

When the 144MHz band (USB), read the main dial against the USB dial gauge when USB waves are completely demodulated and received. (Fig. 6)

When reading VFO, the main dial and subdial must be read and their indications must be added so it seems troublesome at the beginning. But you will get used to it and become able to read VFO frequency quickly and correctly. The subdial's scale from 0 to 1000 corresponds to 1MHz.

The dial cannot be turned beyond a point a little off the 0 to 1000 scale. If it is forcibly turned beyond that point, the gear will break down. Do not turn it excessively.

Fig. 6 How to Read Tuned Frequency



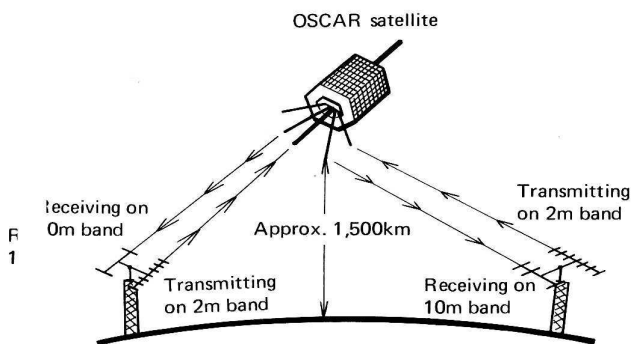
Frequency is $144.000 + 120 \text{ (USB)} = 144.120 \text{ MHz}$. If the band selector switch shows 145, frequency is 145.120 MHz .

OSCAR COMMUNICATION

The conventional satellite communication system requires two sets, i.e., a 2m band SSB transmitter and a 10m band receiver, and a high level of operating technique.

The MULTI-2700 is a multiple-mode 2m band transceiver with a 10m OSCAR receiving converter. It is the first transceiver made in Japan that makes OSCAR communication possible with a single set.

At present, two OSCAR satellites, No. 6 and No. 7, are flying about 1,500 kilometers up in the skies. The MULTI-2700 can communicate via OSCAR 6 or 7 in the A-mode. When signals are transmitted to the satellite on a specified frequency in the 2m band from the MULTI-2700 satellite communication system (called an up-link), the satellite converts the frequency into a 10m band frequency and sends it back to the ground (called a down-link) as illustrated below.



OSCAR satellite transmitting frequency vs receiving frequency diagram.

AMSAT-OSCAR 6

| | |
|-----------|--------------------------|
| Up-link | 145.000 – 146.000MHz USB |
| Down-link | 29.450 – 29.550MHz USB |
| Beacon | 29.450MHz |

AMSAT-OSCAR 7

| | |
|----------------|--------------------------|
| A-mode: | |
| Up-link | 145.850 – 145.950MHz USB |
| Down-link | 29.400 – 29.500MHz USB |
| Beacon | 29.502MHz, 435.100MHz |
| B-mode: | |
| Up-link | 432, 125–432, 175MHz USB |
| Down-link | 145, 975–145, 925MHz LSB |
| Beacon | 145, 972MHz |

An OSCAR satellite receives 2m band signals from the ground and sends them back as 10m band signals. The frequency relationship is maintained constant, keeping the difference between them at 116.45MHz (145.9 – 116.45MHz = 29.45MHz).

Actual Operating Method

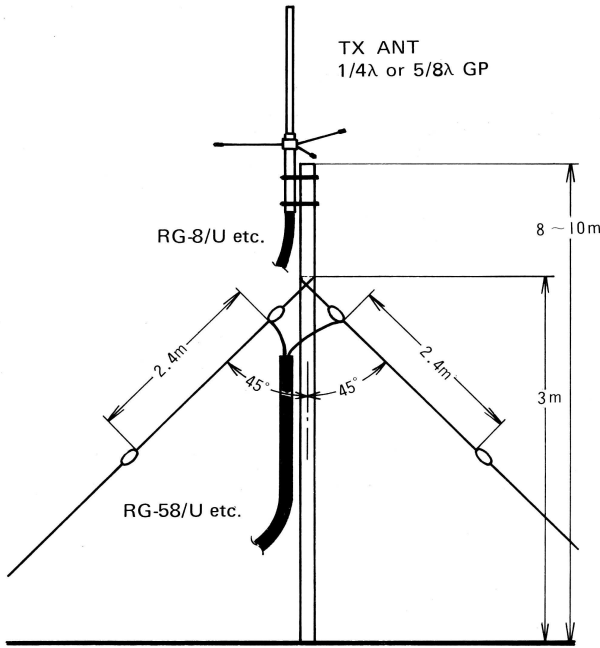
Connect a 2 meter antenna and a 10 meter antenna to the SO-239 connectors to the MULTI-2700.

1. Turn the power switch ON, turn the SELECTOR knob to SIMPLEX until the digital display shows 145.95MHz, which is the beacon frequency (29.50 MHz) of OSCAR 7 in the A-mode.

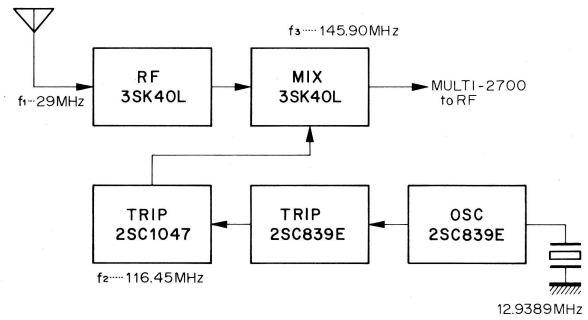
2. Then turn the frequency selector knob at the upper right of the front panel to 145, turn the SELECTOR knob to VFO so that 145.85 to 145.95MHz can be received. When the OSCAR pushbutton is pushed, the transceiver is ready for oscar operation.
3. Then turn the SELECTOR knob again to SIMPLEX and receive OSCAR beacon signals. Turn the VXO knob in the positive direction, i.e., clockwise, so that beacon signals can be heard.
4. Turn the SELECTOR knob to VFO and receive signals within the range of 145.85 to 145.95MHz (29.4 to 29.5MHz). You can hear stations emitting CQs, beacon signals and signals being exchanged between two stations. Tune in the set to a station emitting a CQ. Still keep the RIT switch in the OFF position.
5. When proceeding to reception, turn the RIT switch to the ON position, and slowly turn the RIT knob from the center position in the positive (+) or the negative (–) direction so you should be able to hear a response. Stop the RIT knob at the point where you have received the response, and keep it there.
6. The OSCAR satellites are not synchronized so communicable time is limited. It is important to communicate briefly. Use SSB or CW. Orbit time is about 1 hour and 55 minutes, and operation time is approx. 25 minutes per orbit each communication.

Temporarily using antennas, the following instructions should be observed.

1. Direct the antennas to the satellite from time to time to maintain the best communication condition. Turn the SELECTOR knob to SIMPLEX and set the frequency to 145.95MHz (for OSCAR 7), and you can receive beacon signals. But beacon signals appear to drift as the satellite moves. This is due to the Doppler effect. That is, the receiving frequency appears high as the satellite approaches your station and lowers as it moves away from your station.
2. In this case, tune the VXO knob to maximum signal level. If the antenna's beam direction has deviated too far from the direction which the satellite is flying, adjust the antennas to a direction where beacon signal intensity is greatest. You can generally communicate via OSCAR as long as beacon signals can be received.
3. With the MULTI-2700 twin selector system you can enjoy satellite communication in the best possible condition while monitoring beacon signals from a moving satellite with the SIMPLEX synthesizer. It's only one of the unique features of the MULTI-2700.

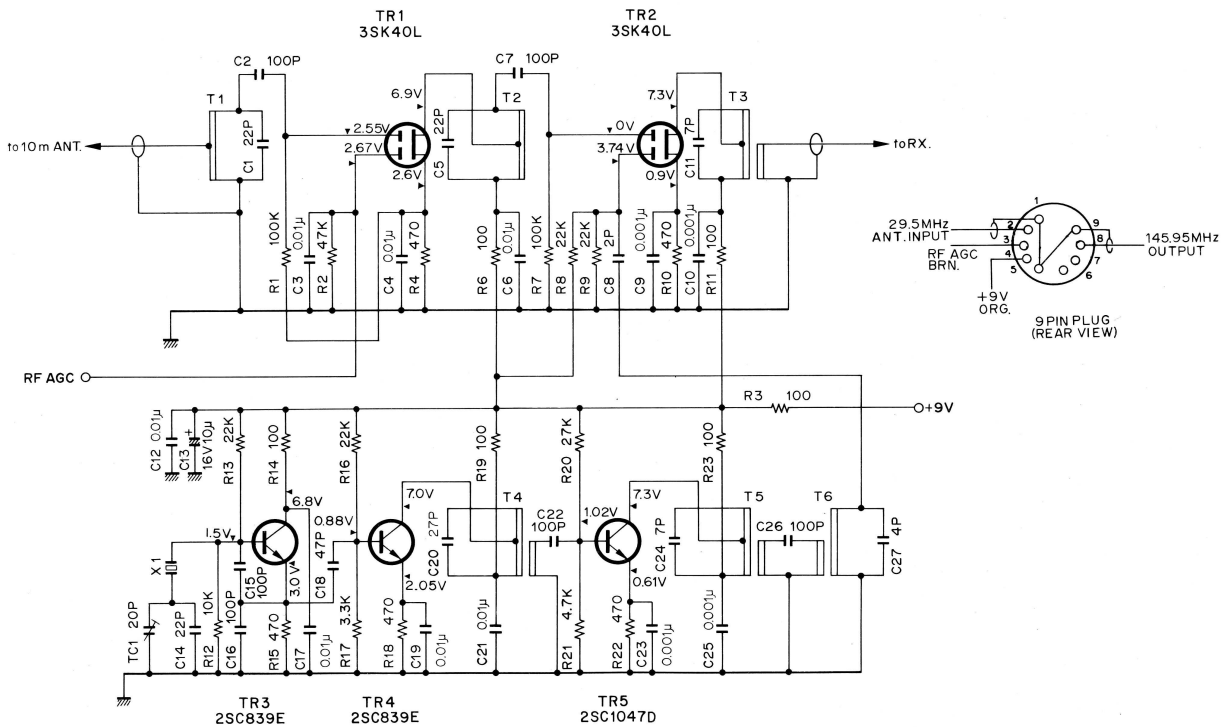


OSCAR CONVERTER BLOCK DIAGRAM



The above-mentioned method applies in cases where you use a GP and inverted V-dipole antenna.
(Temporary recommendation)

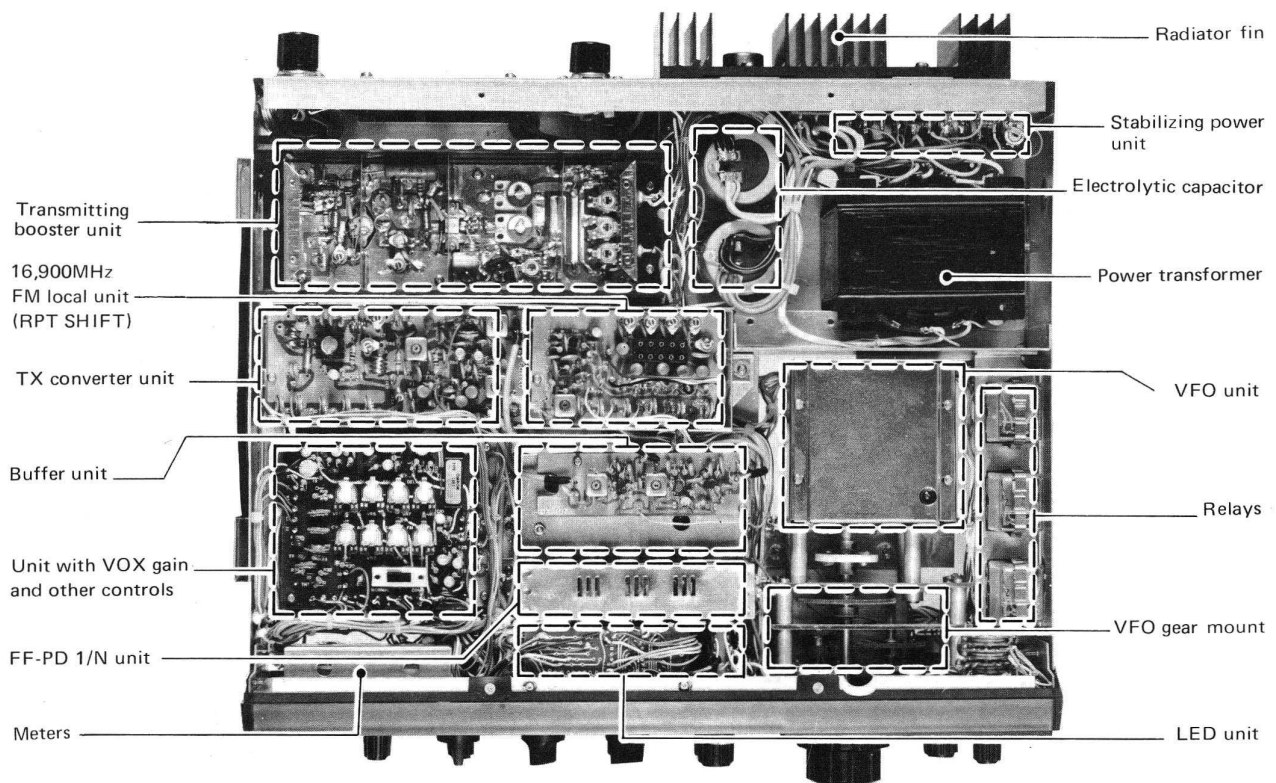
OSCAR CONVERTER SCHEMATIC DIAGRAM



If in case, please be sure to check the antenna system and space conditions, still not properly 10 meters reception or not enough sensitivity oscar reception (10 meter band). Please contact at local dealer/shop or direct to us.
May will be exchange only the oscar converter unit.

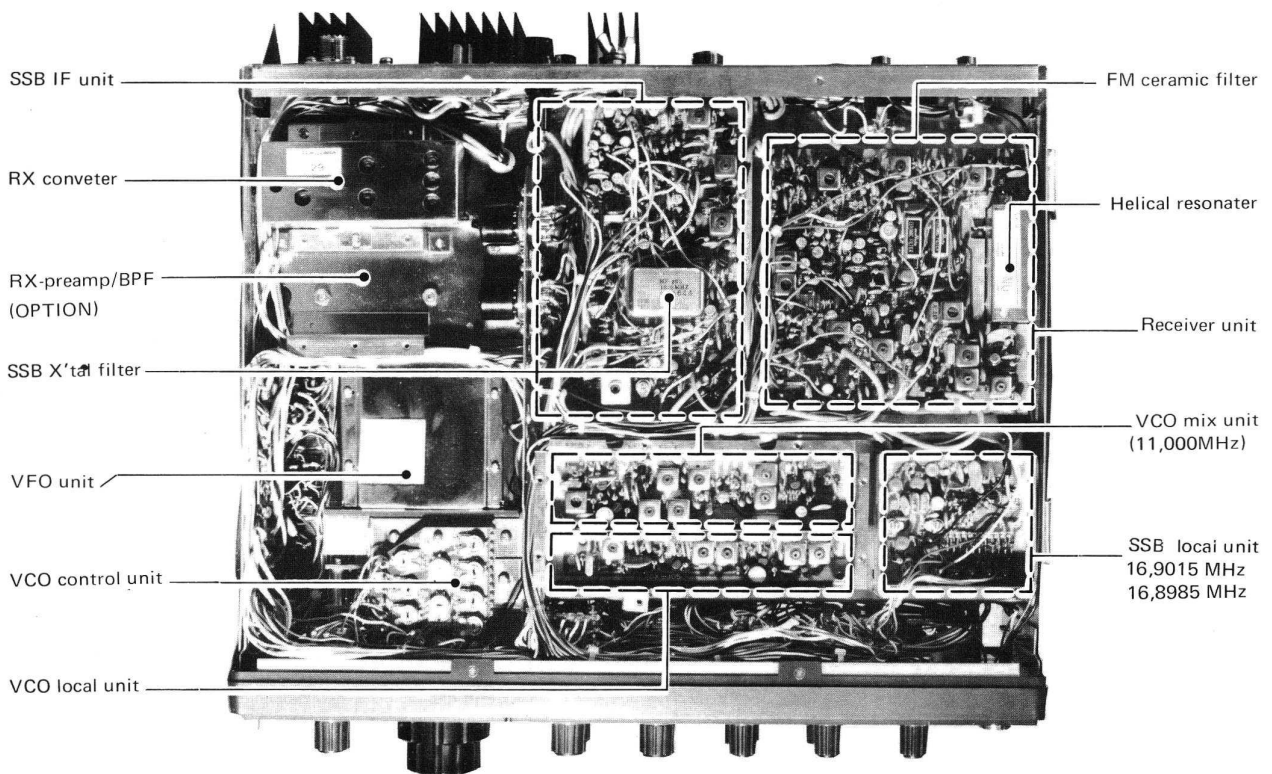
INTERNAL VIEW LOCATION

TOP VIEW



FRONT

BOTTOM VIEW



FRONT

CIRCUIT OPERATION

A block diagram of the MULTI-2700 is shown on Page

The MULTI-2700 consists of 18 units, employing a single superheterodyne system for SSB reception, a double superheterodyne system for FM reception, a filter type balanced modulation system for SSB transmission, and a variable reactance frequency modulation system for FM transmission.

The set employs the following crystal oscillators.

| | |
|----------------------------|------------------|
| PLL section | 10.000MHz |
| | 11.000MHz |
| | 11.344MHz |
| FM LOCAL section | 16.900MHz |
| RX section | 16.445MHz |
| SSB IF section | 16.8985MHz (USB) |
| | 16.9015MHz (LSB) |
| AF section | 10.000MHz |

PLL section

The PLL section consists of 8 units, i.e., X-1, X-2, X-3, X-4, X-5, X-6, X-7 and X-15.

The PLL circuit composition is as shown in the diagram below. The FF-PD unit (X-1) has an IC 10.000MHz oscillator, a 3-stage IC frequency divider which divides 10.000MHz into 10kHz and a phase comparator (PD) which generates a DC voltage for setting a VCO oscillating frequency. The phase comparator converts a phase difference between the reference signal and a signal from the 1/N unit into a DC voltage.

The 1/N unit (X-2) employs 3 ICs for setting the set's operating frequency. 1/N will be 1/300 for the 144.00 MHz; or 1/400 to the 145.000MHz.

The VCO unit (X-3) has an IC voltage control oscillator and a buffer amplifier by which an oscillating frequency will be set depending on the output voltage of PD applied to a variable capacity diode. The VCO unit's output is fed through the buffer unit (X-7) as a transmitting or receiving local frequency. When the 144MHz, the output will be 127.1MHz; when the 145MHz; it will be 128.1MHz.

The VFO unit (X-4) is a very stable VFO which employs a dual gate MOS FET for oscillation. It generates frequencies within the range of 11.000MHz to 11.500MHz, and its output is doubled by the VCO-MIX unit (X-6) to cover the 1MHz band area. When the digital synthesizer is in use, the VFO oscillator generates frequencies but the frequency doubler circuit will not operate. Instead, the 11.000MHz crystal oscillator will operate to supply a doubled 22.000MHz signal to the mixer. The mixer mixes a 102.100MHz signal, which is obtained by multiplying by 9 the 11.344MHz crystal-oscillated from the VCO-LO unit (X-5), and the 22.000 MHz to produce 124.100MHz. This 124.100MHz frequency is mixed with the VCO output to be converted into 2 to 7MHz, which is fed through a low pass filter into the 1/N unit.

The LED unit (X-15) is a unit to indicate the digital synthesizer's operating frequency and consists of 2 ICs driven at the 1/N unit's frequency dividing ratio, 23 diodes and 5 LEDs.

VXO and RIT frequencies are varied as follows:

When VFO is in use, 11.344MHz is varied by RIT; and when the digital synthesizer is in use, 11.344MHz is varied by VXO and 11.000MHz by RIT.

The PLL section is completely sealed except the buffer unit (X-7).

FM local unit (X-8)

This unit generates 16.900MHz for FM transmission.

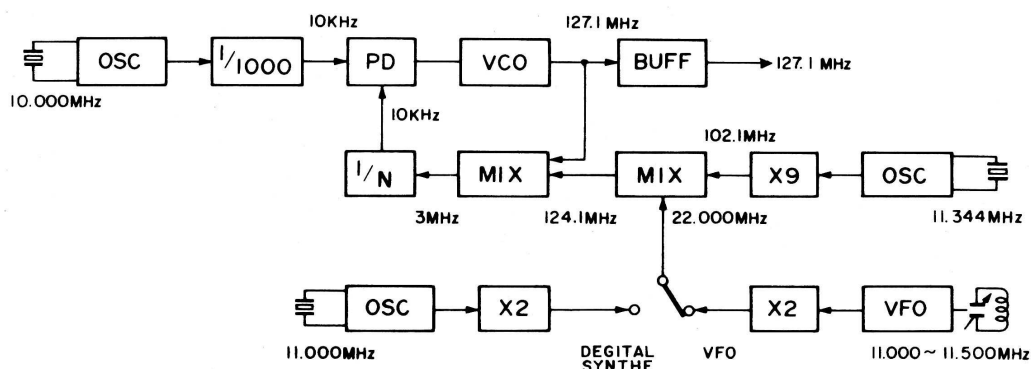
TX converter unit (X-9)

VCO output and 16.9MHz IF signal are converted into 144MHz by a balanced mixer consisting of 2 dual gate MOS FETs, and then amplified in voltage and power. Part of the unit is tuned every 1MHz by a variable capacity diode.

Booster unit (X-10)

This is a 10W output power amplifier circuit, having 2 transistors in a large capacity heat sink. In addition, the unit has a voltage control transistor for output switching, an ALC circuit, APC detecting circuit, etc.

PLL block diagram



CIRCUIT OPERATION

RX unit (X-11)

SSB signals received run through an RF amplifier, helical resonator, heterodyne mixer and a crystal filter into the SSB IF unit. IF frequency will be 16.9MHz. FM signals are then fed through a crystal filter to be converted into 455kHz, and enter a 455kHz ceramic filter. The ceramic filter consists of two parts, one for wide and the other for narrow, either of which can be selected by means of a diode switch. The signals run through a limiter for FM detection before running into the AF section. Two FM squelch noise amplifiers and an AFB amplifier assure Fukuyama's unique smooth squelch operation.

A noise blanker (NB) circuit is built in for SSB. This circuit cancels ignition noise, etc. to make signal reception clear.

SSB IF unit (X-12)

This unit consists of basic circuits for SSB transmission and reception.

Specifically, it has a transmitting ring modulation circuit, a receiving ring detecting circuit, an AGC circuit, an IF circuit for SSB, CW and AM, an SSB AF circuit and an AM detecting circuit that are all built inside the unit. In SSB operation, this unit generates a DSB which is fed through a high-performance crystal filter to be fed out as an SSB. In case of CW, carriers are generated by unbalancing the ring modulator with a DC voltage.

SSB LOCAL unit (X-13)

The unit generates carriers in SSB transmission, and functions as a ring detecting BFO in SSB reception. It uses 2 crystal oscillators for oscillation, and a diode switching, and for selecting USB, LSB or CW.

AF unit (X-16)

A large-capacity IC is used as a power amplifier for received AF. The unit has a marker 100kHz oscillation circuit (3 ICs), a CW monitor circuit, a CW keying circuit and a transmission protective circuit (APC).

Microphone amplifier unit (X-17)

This is a transmitting microphone AF amplifier unit for FM, SSB and AM. FM signals run through a preamplifier, 2 AF amplifiers, IDC, an integrating amplifier and a splatter filter to a wide-narrow selecting diode switch. Thus the VCO unit's variable capacity diode is directly modulated.

In SSB and AM operation, signals run through 3 AF amplifiers and the splatter filter to the SSB IF unit. The X-17 unit has compression amplifier, which assure an excellent effective SSB, AM DX communication.

VOX unit (X-18)

The unit has an AF amplifier, Schmitt circuit and a DC amplifier for VOX operation (voice control operation). The unit offers sufficient VOX gain, and is complete with an anti-trip delay circuit for satisfactory VOX operation. The unit also has a CW break-in circuit. The unit has microphone gain (FM, SSB), VOX gain, anti-trip gain, delay time, CW monitor gain, SSB-AGC time constant and compressor gain control knobs and a compressor switch.

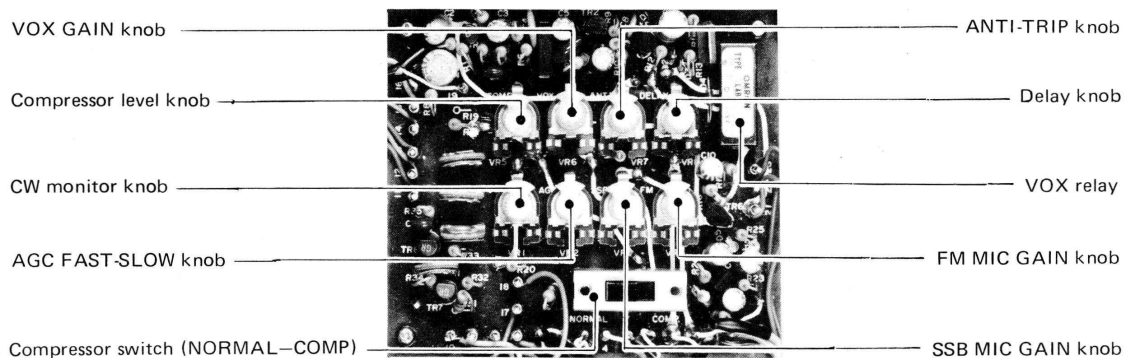
AVR unit (X-14)

The set operates on either AC or DC.

The unit has a rectifier bridge installed in a large-capacity heat sink, a current control transistor, power transformer, and various control circuits on a printed circuit board to generate five voltages, i.e., 13.5V, 9V, 7V, 6V and 5V. Each of these voltages is completely stabilized before being supplied to each circuit of the units.

The photo below shows the controls located inside of the hatch (X-18). Use them appropriately whenever necessary.

Top view, when open the hatch

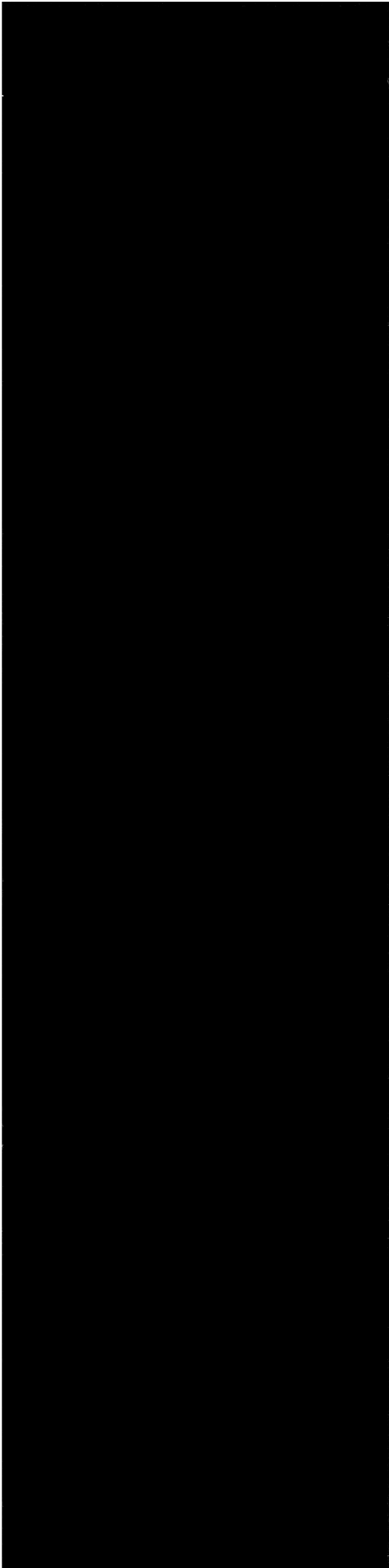


TROUBLESHOOTING

The symptoms shown in the table below do not necessarily indicate faults. Please carefully check the set against the table. If trouble persists even after an appro-

priate step has been taken please contact the Dealer/shop or our company immediately.

| Symptom | Cause | Remedy |
|---|---|---|
| No power | <ul style="list-style-type: none"> Power cord is not plugged in properly. Fuse is blown. | <ul style="list-style-type: none"> Plug it in completely. Replace fuse. (Turn power switch ON. If fuse is blown again, something is wrong.) |
| No sound from speaker | <ul style="list-style-type: none"> AC plug is not fully inserted into electrical outlet. Speaker voice coil is broken. Headphone is plugged into headphone jack. | <ul style="list-style-type: none"> Insert it fully into it. Replace speaker. Disconnect headphone from jack. |
| No signals can be received when antenna is connected. | <ul style="list-style-type: none"> Coaxial cable is disconnected or not soldered properly. SELECTOR switch in wrong position. | <ul style="list-style-type: none"> Resolder securely. Set it to SIMPLEX or VFO. |
| Poor sensitivity | <ul style="list-style-type: none"> Antenna is not well connected to antenna connector, or coaxial cable is about to break. RF GAIN knob is in center position. | <ul style="list-style-type: none"> Insert antenna connector (PL-259) again into antenna socket securely. Turn RF GAIN knob (to MAX position). |
| SSB signals are received but no sound comes out. | <ul style="list-style-type: none"> MODE selector switch is set at other than USB/LSB & CW position. | <ul style="list-style-type: none"> Set MODE switch to USB/LSB & CW position correctly. |
| Frequency will not move even if RIT knob is turned. | <ul style="list-style-type: none"> RIT switch is in OFF position. | <ul style="list-style-type: none"> Turn RIT switch to ON position. |
| Receiving and transmitting no problem, except can not be communication. | <ul style="list-style-type: none"> Transmit and receive frequency is differenced. | <ul style="list-style-type: none"> RIT switch off position or correctly 0 position. |
| No transmission | <ul style="list-style-type: none"> Microphone connector is not properly connected so PTT switch does not work. Coaxial cable is broken or shorted. | <ul style="list-style-type: none"> Insert microphone connector securely (or check connector wiring). Check antenna system. |
| No SSB output | <ul style="list-style-type: none"> SSB MIC GAIN knob is turned to MIN position. Microphone is faulty. | <ul style="list-style-type: none"> Open top cover and turn SSB MIC GAIN knob clockwise. Substitute microphones. |
| Lack of modulation depth in FM | <ul style="list-style-type: none"> FM MIC GAIN knob is turned to MIN position. Microphone is faulty. | <ul style="list-style-type: none"> Turn FM MIC GAIN knob clockwise. Replace microphone. |
| No digital display | <ul style="list-style-type: none"> SELECTOR switch is not in FM mode SIMPLEX or DUPLEX. | <ul style="list-style-type: none"> Set it to FM SIMPLEX or DUPLEX. |
| Ham station can not be received when VFO dial knob is turned. | <ul style="list-style-type: none"> SELECTOR switch is not at VFO. SELECTOR switch at upper right on front panel is out of position. | <ul style="list-style-type: none"> Set it to VFO. Select 144, 145, 146, 147MHz switch position. |
| Nothing but local stations can be received in FM. | <ul style="list-style-type: none"> SQUELCH knob is turned fully clockwise. | <ul style="list-style-type: none"> Turn it counterclockwise to a point just before plain noise begins to be heard. |
| Lamps will not light. | <ul style="list-style-type: none"> Lamp is burnt out. | <ul style="list-style-type: none"> Replace lamp (or check wiring). |



FUKUYAMA

electronics
Tokyo, Japan

