

**144MHZ SSB-CW
TRANSCEIVER**

SB-2M

mizuho

Congratulations on the purchase of your Mizuho 2-meter SSB-CW transceiver SB-2M, with all the following features.

- * Very compact size and light-weight transceiver with a built-in whip antenna allows easy field and portable operation.
- * Double-balanced mixer in the transmitting circuits prevents spurious radiation.
- * Double-balanced modulator provides great carrier suppression and also functions as a demodulator at the receive mode for stable SSB-CW reception.
- * For great sensitivity, dual-gate MOS FET's are used for all the RF and IF circuits.
- * A very stable VXO is used for the local oscillator and allows 5kHz read-out.

CAUTION: Please READ THESE INSTRUCTIONS very carefully before use.

SPECIFICATIONS

GENERAL

Frequency range	:	144.20 – 144.40 MHz (crystal included)
Mode	:	A3J (USB), A1
Antenna impedance	:	50 ohms
Frequency stability	:	within 200Hz per 30 minutes from 60 minutes after power on
Number of semi-conductors	:	Transistors : 10 FET's : 9 IC's : 3 Diodes : 20 (LED included)
Power requirement	:	12 – 13.5V DC (operationable: 10 – 14V DC)
Current	:	400mA max. at transmitting 70mA at receiving with no signal
Dimensions (W x H x D)	:	120mm x 56mm x 190mm
Weight	:	1.4kg (batteries and microphone excluded)

TRANSMITTER

RF output power	:	1 watt (PEP)
Spurious radiation	:	less than –50dB
Carrier suppression	:	more than 40dB
Unwanted side band suppression	:	more than 40dB

RECEIVER

Receiving system	:	single conversion
Intermediate frequency	:	9 MHz
Sensitivity	:	less than 0.5 μ V for 15dB S/N
Selectivity	:	more than 2.4kHz at –6dB less than 4.8kHz at –60dB
Audio output	:	1 watt with 8 ohms load

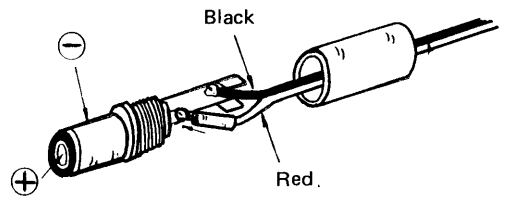
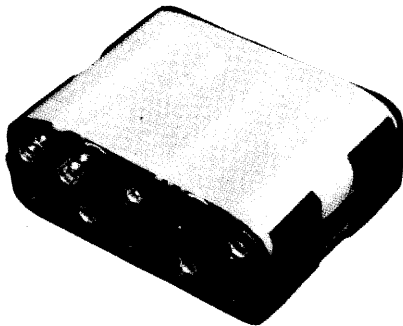
BATTERY INSTALLATION

1. Pull the plastic snaps on the rear panel until they click.
2. Install AA-cell or UM-3 batteries in the battery holder. When 1.5V batteries are used, install 9 batteries and the included dummy battery. When 1.2V batteries, such as Ni-Cad batteries, are used, install 10 batteries. Be sure to wrap the batteries with the insulating sheet to prevent any unexpected short which may be caused between the chassis of the SB-2M and the battery cases.
3. For battery operation, make sure that the external power cable is disconnected from the external power jack.

EXTERNAL POWER SUPPLY CONNECTION

1. Use a voltage regulator which supplies 12.0 – 13.5V/1A or more as an external power supplier.
2. Use the included external power plug and connect the red lead wire to the positive terminal and the black lead wire to the negative terminal of the power supplier.
3. Connect the plug to the power jack on the rear panel. When the plug is inserted into the jack, the battery circuit is automatically disconnected.

How to use the insulating sheet

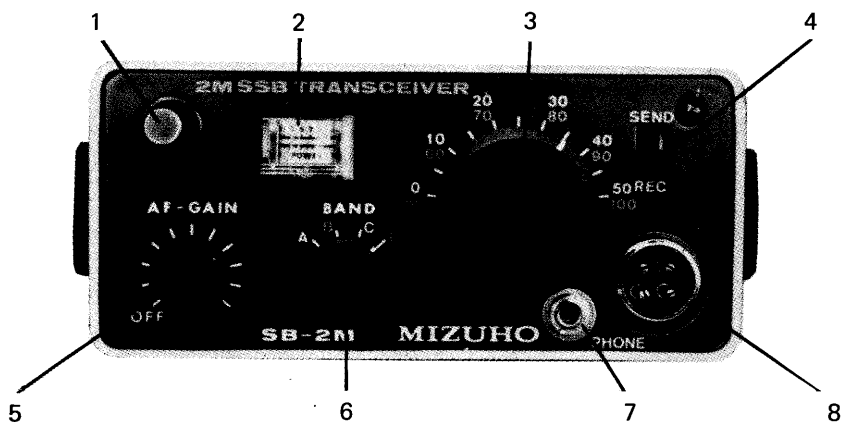


EXTERNAL ANTENNA CONNECTION

Use any 2-meter antenna with an impedance of 50-ohms and a 50-ohm coaxial cable. If possible, use a high gain antenna, such as a beam antenna, which is set as high as possible. Any 50-ohm coaxial cable can be used, but use of low-loss cable is recommended. Try to make the length of the coaxial cable as short as possible.

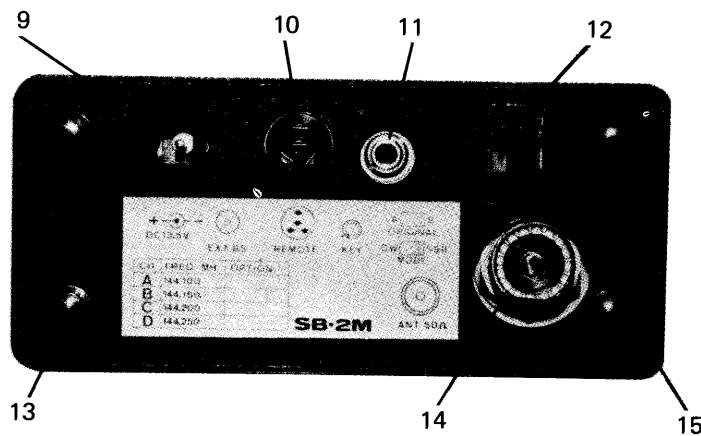
For connection with the SB-2M, use a PL-259 connector and connect it to the antenna receptacle on the rear panel of the unit. At this time, make sure that the telescoping whip antenna is completely collapsed into the unit.

FRONT PANEL CONTROL



1. WHIP ANTENNA
When used, extend fully; when an external antenna is used, collapse it completely into the case.
2. S/RF METER
Functions as S-meter in the receive mode and as a relative RF output meter in the transmit mode. These functions are switched automatically.
3. TUNING CONTROL
Covers 50kHz. Read the white scale when the band select switch is at the A or C position and the yellow scale when at the B or D position. The numbers on the scale indicate kHz.
4. SEND/REC SELECT SWITCH
Sets the SB-2M in the transmit mode when the switch is at SEND and in the receive mode when at REC.
5. AF-GAIN CONTROL
To adjust the receiving audio level, and also for the power ON/OFF switching. Turn the knob completely counterclockwise beyond the click to turn the power off.
6. BAND SELECT SWITCH
Selects the operating frequency range. The SB-2M is set for operation between 144.20 and 144.40MHz at the factory. For the frequency coverage of each band, refer to SSB OPERATION on page 4.
7. EARPHONE JACK
Use an 8-ohm earphone. When the plug is inserted into the jack, the speaker is disconnected automatically.
8. MIC JACK
Accepts a 600-ohm microphone. For use of a microphone other than the included microphone, refer to the MIC CONNECTION figure on page 5.

REAR PANEL CONTROL AND CONNECTION



9. EXTERNAL POWER JACK
For use with an external power supply. Use a 12 – 13.8V DC regulated power supply which has 1A current capacity or more.
10. FOUR-PRONG REMOTE JACK
For remote control to use with a linear amplifier, etc. Refer to FOUR-PRONG REMOTE JACK on page 5 for the wire connections.
11. KEY JACK
Accepts the included CW key plug.
12. EXTRA SWITCH
Not wired to any parts. Use this switch when your original circuits are built into your SB-2M.

13. PLASTIC SNAPS

For the case locking. Pull these for removing the case and push for locking after setting the case properly.

14. EXTERNAL ANTENNA CONNECTOR

Accepts PL-259 connector for an external antenna connection.

15. MODE SELECT SWITCH

Selects the transmitting mode. Set to the right for SSB and to the left for CW operation.

OPERATION

SSB OPERATION

1. Connect the included microphone to the MIC jack on the front panel.
2. Make sure that the SEND/REC switch is on REC, and then turn the power on by turning the AF-GAIN control up to where noise can be heard from the speaker at a suitable level.
3. Set the BAND selector to the desired frequency range.

The SB-2M has been preset for operation in the following frequency ranges.

A: 144.200 – 144.250MHz

B: 144.250 – 144.300MHz

C: 144.300 – 144.350MHz

D: 144.350 – 144.400MHz

Read the white scale for 10kHz digit or below in the A and C bands and the yellow scale for the B and D bands.

Example: With the BAND selector at the D position and the TUNING control between the yellow 80 and 90 as shown in the photo:

D: 144.350 – 144.400MHz

..... yellow letter reading

Tuning control: 85

Therefore the operating frequency is
144.385MHz.



4. Set the MODE switch on the rear panel to the SSB side (right side).

5. Now you are ready for SSB operation.

Transmit/Receive can be controlled either by the PTT switch on the microphone or the SEND/REC switch.

If the built-in whip antenna is used, be sure to extend the whip antenna completely.

Note: Make sure that the key plug is not connected to the KEY JACK.

CW OPERATION

1. Plug the CW key plug into the KEY JACK on the rear panel.

Refer to the figure on page 5 for key plug connection to a keyer.

2. Set the MODE switch on the rear panel to the CW side (left side).

The mic amplifier circuit is automatically disconnected so that the microphone can be left connected.

3. For reception of CW signals, turn the TUNING control so that CW signals can be heard at approximately 700 – 800Hz. This tuning procedure provides transmitting exactly on the receiving frequency, because SB-2M is designed so that the transmitting frequency on CW mode is shifted approximately 700 – 800Hz automatically.

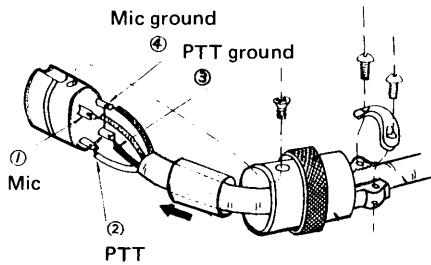
4. Other operation procedures are the same as for SSB.

Note: In SSB operation, be sure to remove the plug from the KEY JACK.

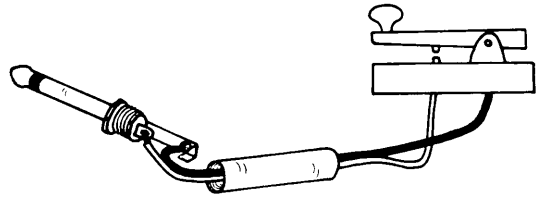
Otherwise, no SSB signal is transmitted.

PLUG CONNECTION

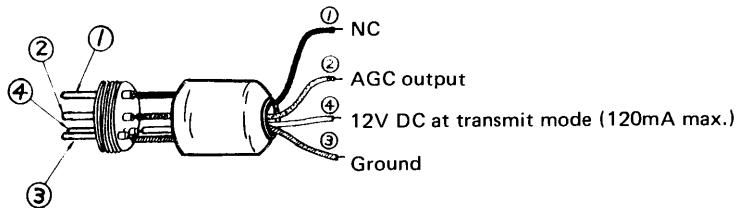
Mic Plug



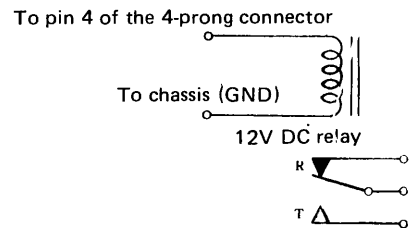
Key Plug



For-prong remote plug



If external switching is required, use 12V DC relay which drains less than 120mA.



INCLUDED ACCESSORIES

Shoulder belt	1	Microphone	1
Microphone hanger	1	External power cord with plug	1
Screws for mic hanger	2	Key plug	1
Washers for mic hanger	2	Dummy battery	1
Battery box	1	Insulating sheet for batteries	2
Instruction manual	1		

VXO TRACKING ADJUSTMENT

When crystals are replaced or installed or when the operating frequencies do not match the scale, make tracking adjustment according to the following procedures.

1. Remove the case of the SB-2M and set the speaker side of the SB-2M up.
2. Prepare a frequency counter which can measure at least up to 140MHz. Connect the lead of the frequency counter to Pin 3 of the PCB and the ground lead to Pin 4 which is the ground, as shown in the figure.
3. Turn the SB-2M on and set it in the receive mode.
4. Refer to the table for the coils or trimming capacitors which are to be adjusted. The cores of the coils are to be adjusted at the lowest end of the frequency ranges and the trimming capacitors are to be adjusted at the highest end of the frequency ranges.

Channel	Coil	Trim. capacitor
CH A	L4	CVT4
CH B	L3	CVT3
CH C	L2	CVT2
CH D	L1	CVT1

Since the displayed frequency on the frequency counter is that of the local oscillator, determine the receiving frequency from the displayed frequency on the counter and the following formula.

$$\text{Receive/transmit frequency (MHz)} = \text{Displayed freq.} - 8.9985\text{MHz}$$

For example, when the required operation range with a crystal is 144.950 – 145.000:

$$144.950 - 8.9985 = 135.9515 \text{ MHz}$$

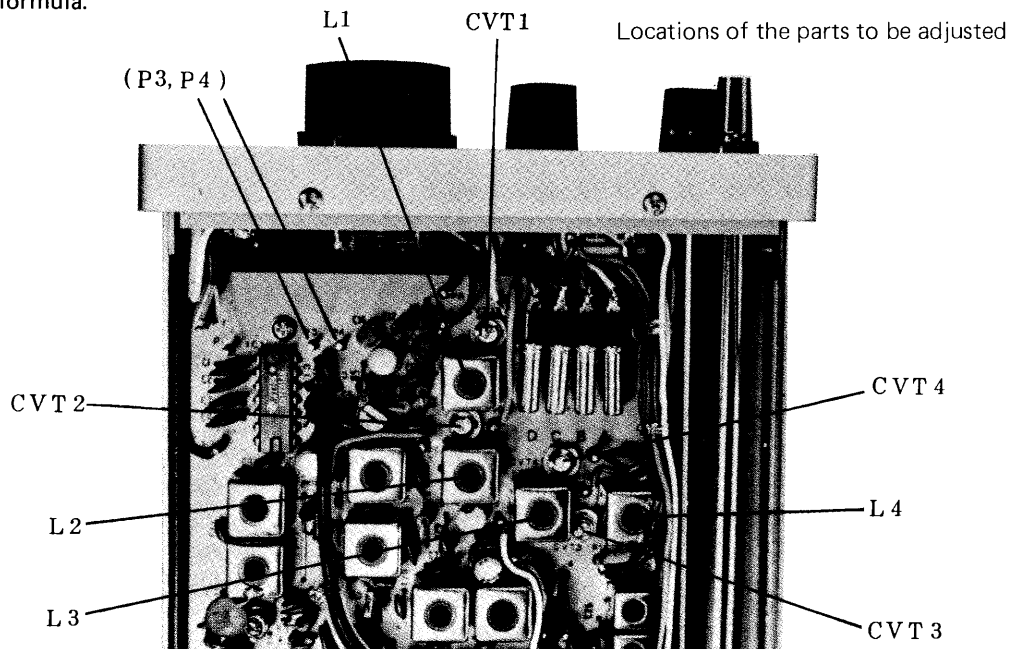
$$145.000 - 8.9985 = 136.0015 \text{ MHz}$$

Therefore the displayed frequency on the counter must be 135.9515MHz when TUNING control is set at the lowest end and 136.0015MHz at the highest end.

5. Set the TUNING knob at the lowest end and turn the core of the coil for the band to which the BAND selector is set so that the desired frequency can be read on the frequency counter.
6. Set the TUNING knob at the highest end and adjust the trimming capacitor for the same band so that the desired frequency (50kHz higher than that measured in 5) can be read.
7. Follow the procedure shown in 5 again and then that in 6 again. Repeat these procedures three to four times until the frequencies at both ends are correct.

The VXO tracking adjustment is now completed.

8. Follow the same procedures for tracking adjustment for the other bands following the table above and the formula.



OTHER ALIGNMENT

Receiver alignment

The SB-2M is tuned for operation between 144 and 145MHz at the factory. When operation above this range is required, retuning is necessary.

Receive the center of the frequency range (1MHz wide) you are interested in operating. Adjust the coils, L11 – L14 of the TB-2M PCB, for the highest noise level.

For IF alignment, adjust L9 and L10 of the TB-2M PCB and L1, L2, and L3 on the SB-9 PCB for the highest noise level.

Transmitter alignment

Connect a 50-ohm dummy load to the antenna connector of the SB-2M.

Set the SB-2M in the CW mode and set for the transmit mode.

Adjust L15 – L18 and CVT5 – CVT8 (trimming capacitors) on the TB-2M PCB for the maximum RF output.

Carrier balance alignment

Adjust VR-1 on the SG-9 PCB for the minimum carrier level.

S-meter zero-set

Adjust VR-2 on the SG-9 PCB so that the S-meter indicates "0".

Mic gain adjustment

Adjust VR-3 on the SG-9 PCB for the proper mic level. Turn it counterclockwise for higher gain.

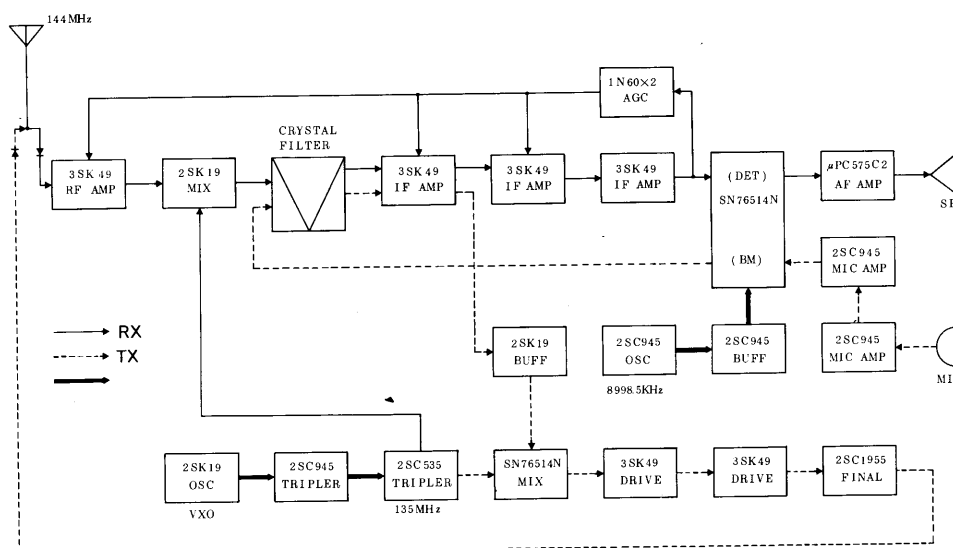
Carrier oscillator frequency alignment

Connect a frequency counter between the lead of C-50 capacitor on the SG-9 PCB (the lead which is on the IC side) and the ground.

Adjust CVT-1 trimming capacitor so that the counter indicates 8998.5kHz.

NOTE: This alignment is not necessary in normal use. If necessary, read the procedures very carefully and prepare beforehand all the equipment and tools which you will need for the proper adjustment.

SB-2M BLOCK DIAGRAM



SB-2M CIRCUIT DIAGRAM

