

OPERATORS MANUAL

UHF CB BAND MOBILE TRANSCEIVER **SAWTRON 999**

Complies with D.O.C. Specification RB 250
(Approval 12500039)



The SAWTRON 999 has been recently developed as a new and improved version of UHF CB Band Mobile Transceiver.

In order to keep your set in good condition, please read this Manual carefully before use.

Should you have any questions or problems, do not hesitate to contact your dealer or us directly for help.

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1. FEATURES

■ Direct PLL synthesizer system (1-40 channels)

This PLL unit complies with the 25kHz channel spacing arrangement in the UHF CB Band. The SAWTRON 999 complies with D.O.C. Specification RB 250. The Approval # is 2500039.

■ Various scanning methods

Four (4) scanning methods

Manual Scan, Memory Scan, Priority and Memory/Priority Scan are available for optimum receiving operation.

MANUAL SCAN

: Scans all the 40 channels which are programmed in the transceiver.

MEMORY SCAN

: Scans the channels programmed as 'MEMORY' channels. (Max.40 channels)

PRIORITY OPERATION

: A touch on the PRIORITY key provides an instant shift from any channel to the PRIORITY channel designated.

MEMORY-PRIORITY SCAN

: This mode scanning stops at any non-priority channel where the signal is present for 2 seconds, and moves to PRIORITY channel to receive for 100 milliseconds.

If the signal is present in PRIORITY channel, scanning stops at PRIORITY channel and the receiver is held at PRIORITY channel.

If the signal is not present in PRIORITY channel, scanning returns to the former channel and repeats scanning cycle like this.

■ Direct FM modulation

The Direct FM modulation system provides excellent audio quality.

■ TTL (Transmit Time Limiter)

A programmable Transmit Time Limiter (TTL) is incorporated in the control head.

■ RF hybrid power module

A commercial duty hybrid power module is employed as the final stage, assuring constant maximum legal power output.

■ An integrated 2W speaker provides accurate audio reproduction.

Additional audio output is available with an optional 4W external speaker.

■ Remote control operation

Optional remote control kit enables remote transceiver installation.

■ Many optional items available

CTCSS, 5-tone, 5-tone & CTCSS, DTMF, Digital Privacy Unit etc., are selectable to suit particular customer requirements.

2. STANDARD COMPOSITION

Transceiver unit	1 pcs.
Mounting bracket	1 pcs.
DC power supply cord	1 pcs.
Hand microphone	1 pcs.
Fuse (spare)	2 pcs.
EP-ROM	Installed in radio
Installation screws	1 kit.

3. OPTIONAL ITEMS

Item	Model
Remote control kit	RCRCOM-I
External speaker with cable and plug	SEEXT-L
5-tone encode/decoder	CP-5T0A
CTCSS	CP-SC1(A) / CP-SC1(C)
CTAF	
Digital privacy unit (optional)	
3-tone decoder	
AC power supply unit	FR-3105
Stand microphone	ESM-105M
EP-ROM programmer	APB203
EP-ROM eraser	Quick-ET

4. SAWTRON 999 SPECIFICATIONS

General	
Frequency range :	475 - 425 - 477 - 400MHz
Number of channels :	40 channels
Number of programmed SCAD channels :	40 channels maximum
Channel spacing :	25 kHz
Mode of operation :	Single or dual frequency simplex press-to-talk system
Antenna impedance :	50 ohm unbalanced
Power supply and power consumption :	1.3 8V DC \pm 20% negative ground, 2.5A
Environmental conditions :	Ambient temperature : -10°C to +50°C Relative humidity 95% at +25°C
Dimensions and weight :	175 mm width 44 mm height 175 mm depth 1.5 kg
Transmitter	
RF power output :	5 watts
Maximum frequency deviation :	\pm 5 kHz
Frequency stability :	\pm 0.0005%
Frequency response :	Wide \pm 1, -3dB of full voice ps emphasis from 0.3 to 3kHz, 10% reference
Signal to noise ratio :	More than 45 dB at 1 kHz 70% modulation
Modulation distortion :	Less than 3% at 1 kHz 70% modulation
Splurious and harmonics :	More than 70 dB down below rated power
Receiver	
Intermediate frequency :	1st IF 21.8 MHz 2nd IF 455 kHz
Frequency stability :	\pm 0.0005%
Sensitivity :	Less than 0.25 μ V for 20 dB noise gating Less than 0.25 μ V for 12 dB SINAD
Squelch sensitivity :	Less than 0.25 μ V
Bandwidth :	More than 12 kHz for 6 dB down
Selectivity :	More than 60 dB at 25 kHz point
Blocking :	More than 70 dB
Intermodulation :	More than 70 dB
Spurious responses :	More than 70 dB
AF response :	Wide \pm 1, -3dB of full voice ps emphasis from 0.3 to 3kHz, 10% reference
AF output :	More than 2 watts into 4 ohm load, 0 dBm \pm 3 dB at 800 ohm balanced line External speaker : 4 watts into 4 ohm load
AF distortion :	Less than 5% at 1 kHz 70% modulation
Signal to noise ratio :	More than 45 dB at 1 kHz 70% modulation

5. INSTALLATION INSTRUCTIONS & PRECAUTIONS.

(1) Location of the SAWTRON 999

The recommended installation position is under the dash or near the console box area. Don't place the radio in the vicinity of the air conditioner ducts. Follow the installation instructions below for the radio and microphone installation.

Be sure there is enough clearance for the heat to dissipate from the rear radiator. Installation where natural air flow is available is recommended. Avoid installations where high temperature, high humidity and/or dust is prevalent.

(2) Power cable wiring

The SAWTRON 999 operates from a DC 12V battery. ALWAYS check the battery voltage if the SAWTRON 999 is to be fitted to a large truck, as most trucks use a 24V electrical system. ALWAYS use a DC-DC converter when operating from a 24V battery. Connect the DC power cord directly to the battery.

NOTE 1 - Don't connect the DC cord in a manner which links it with vehicle ignition switch system, otherwise the CPU memory will be erased each time the engine is switched OFF and left OFF for more than a few minutes.

NOTE 2 - The SAWTRON 999 is always shipped with its EP-ROM installed. However, if it is removed for any reason, ALWAYS be sure that the EP-ROM is installed in the radio before connecting the DC cord to the battery. If the DC cord is connected directly to the battery, the CPU will be alive even if the radio is switched off. Installation of the EP-ROM while the DC cord is connected may cause a malfunction.

(3) Microphone connection

Put the microphone plug in the microphone socket mounted on the radio front panel and fasten the ring to secure the connector tightly. Loose connections may cause faulty operation. If the radio is equipped with Tone Squelch or 5-Tone, the microphone hanger MUST be connected to the chassis ground by a wire, as Tone Squelch or 5-Tone disable feature operates through the hang-up button on the back of the microphone.

(4) Installing the main unit (See Figure 1)

Be sure that there is enough clearance for the microphone and power cables.

Using the fixed bracket as a template, mark and drill the mounting holes as follows :

As illustrated, cause the main unit to slide into the bracket to an appropriate position. Then, squeeze forcibly the left and right projections of the lever and the bracket bottom with your hands. The bracket will be stamped automatically in position.

To remove the main unit from the bracket, press Release Button at the center of the bracket. Then, the bracket is unlocked and the main unit comes out automatically.

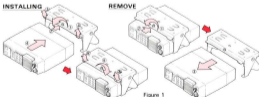


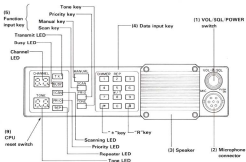
Figure 1

(5) External speaker connection

Connect the external speaker to the connector provided on the rear of the radio. Insertion of the plug disables the built-in speaker.

Consult your SAWTRON radio dealer if your SAWTRON 999 gives you any trouble or if you require any further assistance.

6. FRONT PANEL CONTROLS & FUNCTIONS



(1) VOL/SQL/POWER SWITCH

The inner knob controls the power to the SAWTRON 909 and the speaker volume. Depressing it switches the radio "OFF" and releasing it switches the radio "ON". Rotation of the same knob clockwise increases the volume. Turning it counter clockwise reduces the volume. Set the volume to a comfortable listening level.

The Outer knob controls the squelch level. Turn the knob slowly clockwise to the point where the annoying noise just stops.

(2) MICROPHONE CONNECTOR

Be sure to fasten the connector ring. A loose connection may cause incorrect operation.

(3) SPEAKER

A 2W 4 ohm speaker is mounted within the control head. Connection of the optional External Speaker disconnects this internal speaker.

(4) DATA INPUT KEYS

These keys are used to enter data into the computer memory within the SAWTRON 909. This enables the user to control the channel selection, tone code settings for the 5-tone or CTCSS tone options, scanning program, priority program, dimmer selection or REPEATER function setting.

Explanation of tones

Each keystroke entry of data is indicated by an audible "beep" from the speaker, **PROVIDING** the volume is set to an audible level. If you do not hear the "beep", then you should increase the volume level. When a correct set of commands are entered, you will hear the "Correct Entry Tone" which is "booooooep" (1 long beep).



If the wrong data or an incorrect command is entered, you will hear the "Error Alert Tone" which is "beep beep beep" (3 beeps).

Be aware of these different tones as they can save you a lot of inconvenience.

(6) FUNCTION INPUT KEYS

KEY SYMBOL	FUNCTION	FUNCTION DESCRIPTION
	Manual Key	to set channel to advance channel one by one to set Manual Scan function.
	Tone Key	to set the code for the S-tone or CTCSS encoder.
	Scan Key	to be used when setting either Memory Scan or Memory-Priority Scan function.
	Priority Key	to be used when setting the Priority Function or Memory-Priority Scan function.
	Star key	used to separate commands during programming.
	"R" Key	used to provide a second function to command keys during programming.

(6) FUNCTION VERIFY DISPLAY

DISPLAY	FUNCTION	FUNCTION DESCRIPTION
	Repeater	means the radio has the REPEATER function engaged.
	Scanning	means the radio has the MEMORY SCAN function engaged.
	Priority	means the radio has the PRIORITY function engaged.
	Transmit	means the radio is transmitting.
	Busy	means the radio is receiving a signal or that the squelch is open.

(7) TONE CODE READOUT

This LED displays the encode number of the S-tone or CTCSS tone code. When the S-tone unit is installed, the last two digits of the codes will be displayed. When the Multi-Tone CTCSS option is fitted, the programmed code number in the EP-ROM is displayed.

(8) CHANNEL LED READOUT

The channel number selected is displayed.

(9) CPU RESET SWITCH

CPU RESET switch is located right under TONE CODE LED. Function of this switch is to reset CPU memory. Press the switch only when :-

- Control head is replaced.
- EP-ROM is replaced.

It is not necessary to press this switch when battery cable is disconnected (automatic reset).

MICROPHONE CONTROLS & FUNCTIONS

(10) PRESS-TO-TALK SWITCH [PTT SWITCH]

Press this PTT switch to engage the transmitter.

(11) RESET SWITCH

When the radio is fitted with 5-tone selectall, push this switch to set the radio to standby operation.

(12) CALL SWITCH

When the 5-tone selectall is installed, push this switch to transmit the 5-tone selectall codes.

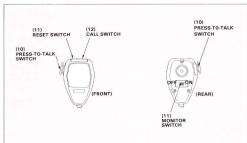
(13) MONITOR SWITCH

This switch is located on the rear of the microphone. When the radio is equipped with the CTCSS or 5-Tone Unit, the functions may be manually disabled by placing this switch in the 'ON' position.

When operating in the MEMORY-SCAN operation, the scan function stops when this switch is placed in the 'ON' position. Scanning will recommence when the switch is returned to the 'OFF' position.

If you intend to use a particular channel (during scanning), then you **MUST** set this switch to the 'ON' position. You **CANNOT** transmit with this switch set at the 'OFF' position.

When the radio is equipped with CTCSS or 5-Tone Unit, set this switch to the 'ON' position and connect the microphone hangar to chassis ground.



7. PROGRAMMING & OPERATING INSTRUCTIONS

7-1 MANUAL CHANNEL SELECTION

There are two methods to select the channel you desire.

Method A- Advances channel numbers sequentially.

When the radio is switched 'ON', the radio displays the channel stored in the memory. A push on the **[MANUAL]** key advances the channel number one by one. If the **[MANUAL]** key is held depressed for more than 2 seconds, channel numbers are continuously advanced at the rate of 8 channels per second. Scanning will stop on any channel on which a signal is present.

Method B- Directly engages the desired channel.

Push the **[MANUAL]** key and then key-in the number of the desired channel. If the channel number is a 2 digit number, enter the 2-digits within a 3 seconds period, otherwise the 2nd digit will be neglected.

[NOTE 1]- No channel number can be selected unless the channel frequencies are programmed in the SAWTRON 999. If you enter an "empty" channel number, then the error alert tone will be heard and no channel number will be displayed.

[NOTE 2]- Be sure to set the Squelch "CLOSED" before you hold the **[MANUAL]** key depressed to continuously advance the channel number, otherwise the channel number will only advance by one.

7-2 MANUAL SCAN OPERATION

In Manual Scan operation, all the channels programmed in the SAWTRON 999 will be scanned. [See NOTE 3 below]

To engage the Manual Scan function, push **[MANUAL]** **[#]** **[1]** keys.

For example :-

[KEY] operation **[MANUAL]** key **[#]** key **[1]** key MANUAL SCAN operation starts.

The LED display "**[--][HI]**" confirms the correct Manual Scan key entry. Then the LED shows "**[-][]**" and begins scanning until it stops at a channel where a signal is present. Scanning will remain stopped as long as a signal is present and will start again after a 2 second pause when the signal is no longer present.

If scanning stops at a channel where a signal is present and you wish to continue scanning, simply push the **[#]** key to advance the channel and continue scanning.

To exit Manual Scan operation, push the **[MANUAL]** key.

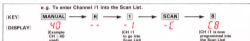
No transmission is possible during scanning. To transmit during Manual Scan operation, set the monitor switch (on the rear of the microphone) to the 'ON' position, and then carry out your transmission. When you have finished transmitting, switch the monitor switch to the 'OFF' position and scanning will recommence. When the radio is fitted with the CTCSS or 5-Tone Unit, it is simply necessary to lift up the microphone from the hanger and transmit by pressing the PTT switch. Scanning will start as soon as the microphone is replaced on the hanger.

[NOTE 3]- Scanning is conducted only on the channels programmed in the SAWTRON 999. Before engaging Manual Scan operation, check the following:
Set the squelch to closed. (Turn the outer control knob clockwise until the background noise disappears).
The microphone must be hung up on the hanger or the monitor switch provided on the rear of microphone set to the 'OFF' position. **No transmission can be achieved when this switch is set to the 'OFF' position.**

7-3-1 'MEMORY SCAN' PROGRAMMING

There are two methods to choose from depending on whether the radio is equipped with Tone Squelch /5-Tone or not, by following Method (B) when programming 'MEMORY SCAN' channels even if the radio is equipped with a Tone Squelch /5-Tone. The operation should be normal in all cases.

Method (A) (for Tone Squelch or 5-Tone equipped radio)



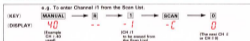
Method (B) (for radios NOT equipped with Tone Squelch or 5-Tone)



(NOTE 4) An "Error Alert Tone" (Beep Beep Beep) will be heard if you attempt to enter channels which are not programmed into the SAWTRON 999 and the function will return back to manual operation.

(NOTE 5) The "Error Alert Tone" will also be heard when programming is repeated on the same channel and the function will return to manual operation.

To Erase Memory Scan Channels.



7-3-2 'MEMORY SCAN' OPERATION

During this operation, scanning is performed only on the channels programmed by the user as MEMORY SCAN channels. The maximum MEMORY SCAN channel capacity is 40. Programming, deleting and reprogramming can be repeated indefinitely. [See NOTE 6 below].

Key entry operations are as follows: -



A flashing ^{1 1 1 1}SCAN LED verifies the correct Memory Scan key entry. Scanning will stop at channels where an incoming signal exists and will resume after a 2 second pause when the signal is no longer present.

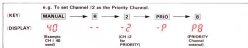
To select another channel during Memory Scan operation, when scanning has stopped on a channel in use, push the ^{1 1 1 1}SCAN key again. Push the MANUAL key to exit from Memory Scan operation. During Memory scanning, no transmission is possible. Lift the microphone off the hanger and press the PTT switch to transmit. Scanning will resume when the microphone is replaced on the microphone hanger or when the monitor switch is set to the "OFF" position.

(NOTE 6) - The channel LED will display [00] and will return to Manual operation after one second if scanning channels are not programmed.
A particular channel can only be programmed into MEMORY SCAN once.

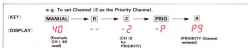
7-4-1 'PRIORITY OPERATION' PROGRAMMING

Again, there are two methods of programming the Priority operation. Choose either one of the two programming methods depending on whether the radio is equipped with Tone Squelch/5-Tone or not.

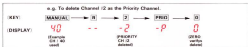
Method (A) (for Tone Squelch or 5-Tone equipped radio)



Method (B) (for radios NOT equipped with Tone Squelch or 5-Tone)



To Delete the Priority Channel



7-4-2 'PRIORITY' OPERATION

In Priority operation, any one of the 40 channels can be programmed as the 'PRIORITY' channel and can be selected by the simple keying step below. The Priority channel can be deleted or reprogrammed at any time. The Priority channel previously programmed is automatically deleted if a new priority channel is programmed.

The keying steps for Priority operation are as follows :-



The **PRIO** LED indicates the correct key entry. The radio now goes to the Priority channel. Push the **MANUAL** key to exit from Priority operation.

(NOTE 7)

Please understand that the Memory Scan function and the Priority function are different. The Memory scan function does not scan the 'PRIORITY' channel unless the channel is either listed as a MEMORY scan channel or the PRIORITY function is engaged.

7-5 'MEMORY-PRIORITY SCAN' OPERATION

This scanning function can be simply described as a mixed scanning of both the Memory channels and the Priority channel functions as explained above. During this operation, scanning will stop at any Non-Priority channel where a signal is present and every 2 seconds will move to the Priority channel to listen for 0.1 of a second. If a signal is present on the Priority channel, scanning will stop and the receiver will hold on the Priority channel. If the signal ceases for 2 seconds or does not exist, scanning will return to the former channel and repeat the scanning cycle as follows :



Method (A)

(Key) operation: **MANUAL** → **SCAN** → **PRIO** → "MEMORY PRIORITY SCAN"

Method (B)

(Key) operation: **MANUAL** → **PRIO** → **SCAN** → "MEMORY PRIORITY SCAN"

The **SCAN** + **PRIO** LED lighting evidences the correct key entry for MEMORY-PRIORITY scan operation. (See Notes B and B-.) To exit this operation, push the **MANUAL** key. During Memory-Priority scan operation, it is not necessary to enlist the Priority channel as one of Memory scan channels. The receiver will always be shifted to the Priority channel and ready to transmit as soon as the microphone is lifted off the hanger or as soon as the monitor switch is set to the "ON" position.

[NOTE B] - If the radio is set to 'Memory - Priority Scan' operation, without programming a Priority channel or Memory Scan channels, the channel LED will display "0" and move to Manual operation after a one second pause.

If the radio is set to 'Priority operation' without programming a Priority channel but with Memory Scan channels, the channel LED will display "0" for one second and then resume Memory Scanning.

As explained before, programming methods for radio equipped with Tone-Squash / S-Tone and for radio without Tone-Squash / S-Tone is different. The difference could be described in other way as below.

Ⓚ PROGRAM [for radio equipped with Tone-Squash / S-Tone]

SCAN stops when the radio receives both carrier signal and tone signal.

In PRIORITY SCAN mode, time needed to shift to PRIORITY channel is 0.5 sec.

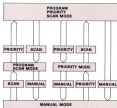
Ⓚ PROGRAM [for radio without Tone-Squash / S-Tone]

SCAN stops when the radio receives carrier signal only.

In PRIORITY SCAN mode, time needed to shift to PRIORITY channel is 0.1 sec.

7-6 RELATIONSHIP CHART FOR INTERCHANGE AMONG MEMORY-SCAN/PRIORITY/MEMORY-PRIORITY SCAN

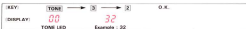
The chart below shows the relationship of each function. It will be easier to change from one function to another if the operator has a better understanding of this relationship.



This chart shows relations among four scan modes.

7-7 TONE CODE PROGRAMMING

To enter the Tone Code for the 5-Tone Selectall or for the CTCSS encoder follow these keying steps as below :



Always input a two digit code figure by adding the "0" key where required.



Tone code entry cannot be achieved without the 5-tone unit PCB or the CTCSS unit PCB being installed in the radio.

If you attempt to enter code figures without those options being fitted, you will receive the error message.

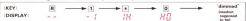
7-8 DIMMER PROGRAMMING

To save the battery current drain, the brightness of the LED used in the SAWTRON 999 radio can be set to a reduced brightness level (dimmer function), except for the 3 seconds after any key operation.

To increase the brightness of the LEDs, push the keys as follow :



To decrease the brightness of the LED's, push the keys as follows :



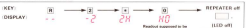
Even with the dimmer function engaged, the LEDs will glow brightly for 3 seconds after any key is pressed before automatically reducing the brightness.

7-9 REPEATER ON/OFF PROGRAMMING

The REPEATER function is provided to enable simple operation on repeater channels. To engage the REPEATER function, enter the keys as follows :



To cancel REPEATER function.



Repeater Frequency Channel Chart

Channel Indicator	Repeater Mode		Simplex Mode	
	Rx Ch.	Tx Ch.	Rx Ch.	Tx Ch.
1	1	31	1	1
2	2	32	2	2
3	3	33	3	3
4	4	34	4	4
5	5	35	5	5
6	6	36	6	6
7	7	37	7	7
8	8	38	8	8

7-10 TONE (High-Low) PROGRAMMING

This function allows the operator to select a High or Low Speaker output tone.
To set the 'Low' tone, push the keys as follows :



To release the Low tone function and to engage the High tone, push the keys as follows :



8. TRANSMIT TIME LIMITER (TTL) TIME SETTING

The SAWTRON 999 incorporates a TTL circuit. The TTL inhibits continuous transmission for more than the specified time and shifts the radio to receive operation automatically. As soon as the TTL time period is exceeded, an alert tone of 2kHz is heard from the speaker and remains audible as long as the PTT switch is depressed.

The TTL time period is adjustable by rearranging the Jumper Switch located on the PCB in the control head according to switch arrangement chart below.

TIME PERIOD	SWITCH #1	SWITCH #2
No Time Limit	ON	ON
30 SECS	OFF	ON
60 SECS	ON	OFF
90 SECS	OFF	OFF

9. EXPLANATION OF TERMS & ABBREVIATIONS

CTCSS- Continuous Tone Coded Squelch System.

This is a system which adds a tone (which the human ear cannot hear) to the transmitted signal. This tone is used to activate other transceivers which are usually set up so that they do not operate unless this tone is present. This is particularly useful if users do not wish to hear other users on the transceivers.

EP-ROM- Erasable Programmable Read Only Memory

This is an integrated circuit installed into the SAWTRON 999 which contains the data used by the computer to select correct operating frequencies and other functions. It can be reprogrammed if required should additional frequencies be allocated to the CBRS users.

LED- Light Emitting Diode

This is an electronic device which is made to illuminate to display information. They are used in the SAWTRON 999 to display the channel numbers, the tone codes (if fitted) and data entry information.

PTT- Press-To-Talk

This refers to the switch on the side of the microphone which is depressed to engage the transmitter when you want to talk with your SAWTRON 999.

REPEATER

A Repeater is a unit comprising of a transmitter and a receiver and other equipment and is usually located on a high mountain or radio tower. It receives a signal on one frequency and retransmits that frequency on another frequency. This provides a much greater area of coverage. Many repeaters are installed in various parts of Australia for free use by the UHF CB users.

SELECALL- 5-Tone Selective Calling System

This is a system which sends out an audible sequence of tones and is used to activate another transceiver with the same selective calling system. It is particularly useful if users do not wish to hear other users on the transceiver.

SQL- Squelch

This is an electronic function fitted to most radios which enables the user to "cut out" the background "hissing" noise which is present during the absence of a strong transmitted signal. This "hissing" noise would become very annoying if it could not be eliminated. The outer control knob is used by the user as described earlier.

CONCLUSION

The SAWTRON 999 represents the latest development in transceiver design technology from Kyodo Communications & Electronics Inc. We assure it will perform excellently for you and trust you will get many years of use and enjoyment from your SAWTRON transceiver.

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