

# 10M ALL MODE TRANSCEIVER



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## Belcom LS-102L OWNERS MANUAL

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*Nihon Dengyo Co., Ltd*

## 1. FEATURES

### FULL COVERAGE OF 28MHZ-30MHz OF ALL MODE

This transceiver is to cover continuously 28MHZ-30MHz in 100Hz step and using a full solid-state line.

LS-102L can be operatable A1A (CW), A3E (AM), J3E (USB/LSB) and F3E (FM) modes.

- **AUTOMATIC RF CIRCUIT TUNING**

The receiver RF-section is obtained automatic tuning system by variable-capacitor diodes so that this can be used without any interference from strong unwanted signals.

- **FEATURES FOR MOBILE OPERATION**

The transceiver is compact in size and very simple operation is required so that it can be smoothly used for mobile operation. The LS-102L features STEP-DIGITAL VFO (100Hz/1KHz selectable) and devoted GEAR MECHANISM incorporated with photo-interrupter.

- **FINAL POWER AMPLIFIER**

Using wideband linear power amplifier incorporated with aluminum heatsink.

- **RIT CIRCUIT**

RIT allows delicate receiver tuning of the SSB incoming signal without fail of the transmitting frequency.

## 2. SPECIFICATIONS

### GENERAL

- Frequency range 28,000 – 29,999 MHz (100Hz step)
- Type of emission SSB (USB, LSB), CW, AM, FM
- Power supply voltage 13.8V DC nominal  $\pm 10\%$ , Negative ground
- Antenna impedance 50 ohm
- External dimension 60H x 190W x 230D (mm)
- Weight 2.8Kg. Approx.

### TRANSMITTER

- RF output . . . . . SSB 10W  
CW 10W  
AM 3.5W  
FM 10W/1W
- Modulation system . . . . . SSB Balanced modulation  
AM Final collector modulation  
FM Variable reactance frequency modulation
- Occupied bandwidth . . . . . SSB 3KHz or less  
CW 500Hz or less  
AM 6KHz or less
- FM Maximum frequency deviation . . . . .  $\pm 5$ KHz
- Unwanted spurious emission . . . . .  $-60$ dB or less

### RECEIVER

- Receiving system . . . . . SSB Single conversion superhetero-dyne  
CW  
AM IF 7.8MHz  
FM Double conversion superhetero-dyne  
1st IF 7.8MHz, 2nd IF 455KHz
- Sensitivity . . . . . SSB  $0.3\mu$ V S + N/N = 10dB  
AM  $1.0\mu$ V S + N/N = 10dB  
FM  $0.5\mu$ V (SINAD = 12dB)
- Image ratio . . . . . 60dB or more
- Audio output . . . . . 2W or more into 8 ohm load
- RIT adjustable range . . . . .  $\pm 1$ KHz along

### 3. PRIOR TO USE

#### 3-1. Installing place

- LS-102L is a communication apparatus which has been adjusted accurately by high quality measuring instruments.

**DO NOT LOCATE THE UNIT IN SUCH PLACES AS SHOWN HEREUNDER TO KEEP THE UNIT AWAY FROM THE DAMAGES**

1. Very hot and humid place
2. Dusty place
3. Place exposed directly to the sunlight
4. Place having poor ventilation

- Keep paying your attention to the above mentioned points, select such a dry place as having good ventilation.

#### 3-2. Power source

- Prior to connect power cables, be sure that the power supply voltage is 13.8V DC.
- Use 13.8V DC stable power supply source when use it for base operation.
- The unit will be used in the negative ground.

#### 3-3. Antenna (CAUTION)

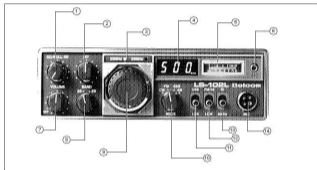
- The matching with antenna is essential. The antenna and coaxial cable must be of 50 ohm and SWR must be as low as possible.

**DO NOT KEY THE TRANSMITTER WITHOUT AN ANTENNA CONNECTED**

- There are many types of antenna available. HF band depends especially on the performance of the antenna. Be sure to select a good antenna which is the best suited for the intended purpose (LS-102L continuously covers 28-30 MHz).

#### 4. ACCESSORIES ENCLOSED

1. Owners Manual .....	1
2. Microphone .....	1
3. Microphone hook .....	1
4. Mounting bracket .....	1
5. Hardwares & others .....	15
6. Fuse 5A .....	1
7. Plugs .....	2



- ① SQUELCH/NO (NOISE BLANKER) SWITCH
- ② RIT (RECEIVER INCREMENTAL TUNING)
- ③ BAND INDICATOR
- ④ FREQUENCY DISPLAY
- ⑤ S/R/F METER
- ⑥ KEY JACK
- ⑦ POWER ON-OFF/VOLUME CONTROL
- ⑧ BAND SELECTOR SWITCH
- ⑨ VFO (MAIN TUNING) KNOB
- ⑩ MODE SELECTOR SWITCH
- ⑪ USB/LSB SELECT SWITCH
- ⑫ POWER HIGH/LOW SWITCH (FM MODE)
- ⑬ 100Hz/1KHz TUNING SPEED SELECT SWITCH
- ⑭ MICROPHONE CONNECTOR

## 5. DESCRIPTION ON FRONT PANEL

### 1. SQUELCH/PULL NB

This is to adjust the operating point of squelch for cutting the noise at no-signal time.

- When turned it fully counter-clockwise, the squelch will be released.
- When turned it clockwise, the squelch will be closed, cutting off the noise.
- Turning it slowly clockwise direction, be sure to use it at such a position where the noise is cut off.
- When pulled out it, the NB (Noise Blanker) will be switched on. The NB is useful to minimize the interference of noise when strong pulse or ignition noise coming.

### 2. RIT (RECEIVING INCREMENTAL TUNING)

This is a knob to adjust receiving frequency correctly on the incoming signal.

- Receive frequency will be as same as transmit frequency when RIT is placed on the center position (center-click mark).
- $\pm 1\text{KHz}$  or more will be tuned along with RIT knob.

### 3. BAND INDICATION LED

The LED will light and indicates the band where selected by **(B)** BAND SELECT SWITCH.

### 4. FREQUENCY INDICATOR

KHz units of operating frequency is indicated in the window.

### 5. S/RFO METER

- On reception, indicates S (signal strength) . . . . . Lower indication
- On transmission, indicates RF (power output) . . . . . Upper indication

### 6. KEY JACK

- Key jack for CW (A1) operation.
- When transmit, push the P-T-T (press-to-talk) switch of the microphone.



## 7. VOLUME/POWER ON/OFF

Knob for volume control with power ON/OFF switch.

## 8. BAND SELECTOR SWITCH

Switch for the selection of 28 MHz or 29 MHz band

## 9. VFO (DIGITAL FREQUENCY TUNING SWITCH)

Knob for tune the desired frequency

## 10. MODE SELECTOR

Select CW/FM/SSB/AM mode.

## 11. USB/LSB SWITCH

Select USB/LSB on the SSB mode.

## 12. FM HI/LO SWITCH

Switch for change over the power output of 10W/1W on the FM mode.

## 13. 1 KHz/100Hz SWITCH

Switch for change over the tuning speed of 1 KHz/100Hz.

## 14. MIC JACK

Connector for the microphone.



**1. ANT. JACK**

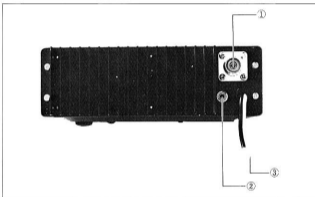
Connector (M-type) for the antenna (50 ohm).

**2. EXTERNAL SPEAKER JACK**

Jack for external speaker or a headphone. Impedance would be 8 ohms.

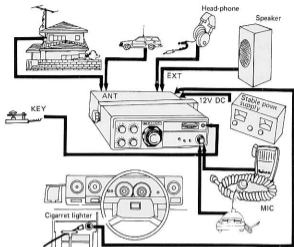
**3. POWER CORDS**

Connector for power supply of 13.8V DC ( $\pm 10\%$ ).





## 6. INSTALLATION



2. Pull the unit forward
3. Adjust the angle
4. Push the radio in
5. Tight the screws
1. Get the screws untight

## 7. OPERATING PROCEDURE

### 7-1. RECEIVER OPERATION

#### (1) Position of switches

- NB ON or OFF
- BAND 28MHz 28.000 – 28.999 MHz  
29MHz 29.000 – 29.999 MHz
- RIT Center position
- MODE Select desired mode
- SQUELCH Fully counter-clockwise position
- VOLUME Turn to clockwise direction and power on.  
Adjust volume to the suitable level.
- VFO Select desired frequency
- 1KHz/100Hz Select tuning speed for your needs  
(Recommend to use 1KHz for FM mode)

#### (2) Power on

When turn volume knob to clockwise, S/RF meter and frequency display LED will be lit.

#### (3) Frequency Indication

Frequency display indicates last 3 digits 000-999 of 28.000 – 28.999/29.000 – 29.999.

#### (4) Frequency tuning

Turn the VFO knob and select desired frequency.

#### (5) Fine tuning

Use RIT when you make fine tuning onto receiving frequency.

#### (6) Noise Blanker (NB)

This is to minimize the interference of the noise when strong pulse or ignition noise coming.

- Pull SQ/NB knob to turn on the NB.

#### (7) Squelch

This is useful on operating FM for cutting noise off when at no-signal time.

- When turned counter-clockwise fully, the squelch will be released.
- When turned clockwise, the squelch will be closed, cutting noise off.
- The control should not be rotated in clockwise more than necessary to eliminate the noise otherwise, you may miss some of the weak signal you may need.

(8) Adjustment of receiving frequency

AM, FM: Adjust the VFO to the maximum reading of S meter.

SSB : The LS-102L operates on USB and LSB mode.

Select USB or LSB by select switch.

Adjust the VFO to the point where the signal can be clearly heard. Use RIT when make fine adjustment after established first call. Place RIT when make a connection with a new station.

CW : Adjust the VFO to the point where the beet tone 800Hz will be heard. At this point, transmit and receive are in same frequency.

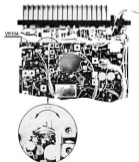
## 7-2. TRANSMITTER OPERATION

(1) AM SSB FM

- Connect a microphone to the microphone connector on the front panel.
- Select desired mode.
- Push the P-T-T (press-to-talk) switch of microphone.
- Speak clearly to the microphone about one inch from the mouth.

(2) CW

- Connect the KEY to the key connector on the front panel with using supplied plug.
- Set the MODE switch to CW position.
- Push the P-T-T switch.
- Send the signal with the key.
- Set the potentiometer VR104 (adjustment of CW monitor) to the comfortable volume.
- Release the P-T-T switch to receive.



TRY NOT TO TOUCH OTHER COMPONENTS

## 8. CIRCUITRY

### 8-1. DIGITAL VFO

The circuit oscillates a 1st local frequency of 35.800.0MHz ~ 37.799.9MHz in a step of 10KHz PLL + 100Hz D-A converter.

### 8-2. DIGITAL CONTROL

The circuit contains pulse counter which counts a pulse from a photo-interrupter, the output signal from the circuit and D-A converter. This circuit also contains FREQUENCY-LOCK circuit, TUNING SPEED switch-over circuit and FREQUENCY DISPLAY DRIVER circuit.

### 8-3. STANDARD CARRIER OSCILLATOR

Mode	TX	RX
USB	7.8025 MHz	7.8025 MHz
LSB	7.7975 MHz	7.7975 MHz
FM	7.800 MHz	
AM	7.800 MHz	
CW	7.8017 MHz	7.8025 MHz

### 8-4. RECEIVER CIRCUITRY

The signal from the antenna through the antenna switching circuit is amplified by dual-gate FET Q301. The amplified signal from Q301 is heterodyned into 7.8MHz IF frequency at Q302 (mixer) by the signal from the digital VFO.

On the FM mode, a portion of the signal from Q302 is fed to IC401 which contains a 2nd local oscillator, a 2nd mixer, a 2nd IF amplifier and a FM detector.

On the SSB, CW, and AM modes, the signal from Q302 is fed through a 7.8 MHz crystal filter to IF amplifier Q304, Q305 and Q306.

### 8-5. DETECTOR, AGC CIRCUIT

AM: The signal from the IF amplifier is detected by D310 and D311. The detected audio signal from D310 and D311 is fed to the audio amplifier through A.N.L. diodes D312 (automatic noise limiter).

SSB: The SSB signal from the IF amplifier is fed to the balanced de-modulator IC501.

CW: Same as SSB

AGC: The AGC voltage from D319/D320 (attack voltage detector) and D314/D315 (release voltage detector), is amplified by Q304. Output of Q309 controls, Q304 and Q305 IF amplifiers and RF amplifier or Q301.

#### 8-6. NOISE BLANKER CIRCUIT

A portion of the incoming signal from the antenna is amplified by IC201 and Q201. The detected pulse signal from Q201 is amplified by Q202. The output pulse of Q202 switches on Q303 and by-pass the RF signal instantaneously to the ground. When the strong signal comes, then the N.B. circuit will be stopped its function by the "killer circuit" consists of D203 and 205.

#### 8-7. AF AMPLIFIER

The detected audio signal is fed to Q401 which works as a audio amplifier and a switching gate of squelch control.

The IC401 amplifies the signal from Q401 and drives a speaker.

#### 8-8. TRANSMITTER

The standard carrier signal and the local frequency signal from VFO are mixed and heterodyned to the transmitting frequency at IC101. The output signal from IC101 is amplified by Q102, Q106 and fed to the antenna through LPF (low pass filter).

#### 8-9. AM MODULATOR

The signal from a microphone is amplified by Q603, Q401 and IC401, and the output signal of IC401 drives Q105 and Q106 through the emitter of Q402.

#### 8-10. SSB MODULATION CIRCUIT

The audio signal from microphone is amplified by Q603 and Q604 and delivered to the balance modulator IC501 where the signal is mixed with reference carrier of 7.8025 (USB), 7.7975 (LSB) to generate, 7.8MHz and 7.805 MHz (USB), 7.795 (LSB). This double side band is rectified by 7.8MHz crystal filter to obtain 7.8MHz (SSB) which is delivered through buffer of Q101 to mixer IC101, after having amplitude with Q304.

IC-101 conducts frequency conversion with VFO output to obtain USB in the range of 28MHz. Q107 and Q108 detect transmitting voltage and if the output power is increased more than 10W, AF ATT Q602 activates to keep the maximum output power in certain level.

### 9-11. CW CIRCUIT

The signal from the key is reversed by Q107 to turn Q109 and Q110 on. Q109 may activate the switching of side-tone-control, Q110 may activates the switching of the emitter of Q102 and Q112 may activates the switching of the carrier. Q110 is always turned on except at CW mode.

### 9-12. FM CIRCUIT

IC501 conducts amplitude, IDC, LFP to feed a direct frequency modulation to VCO of VFO.

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