LD5 – CW/SSB QRP Transceiver

SDR /DSP

Quick guide manual

Description:

At the development base of the digital signal processing unit, an algorithm is embedded for IQ processing of the channels with phase suppression of the unwanted side-band channel.

Unit CPU \ DSP performs the following functions:

- -- ------------------------------
- Digital signal processing
- Frequency synthesizer
- Full control of the transceiver with direct conversion / SDR /

Applicaton:

Due to its small dimensions and light weight this transceiver is suitable for any portable or stationary operation.
This unit contains:
- -CPU STM32F407,
- -NS -24 bit ADC PCM1803,
- -NS -16 bit DAC CS4338 low hissing amp
- -HF-generator Si570
- -1602-line LCD
- -Matrix of buttons
- -Encoder

The unit has electronic CW Iambic key, SWR meter and output power wattmeter.
Functions that this unit performs are separate and switchable for reception / transmission.
They are displayed on the screen display as RX / TX with symbols.

The LD5 is capable of firmware update via USB port. See LNR web page for instructions.

How to order:

LNR Website www.LNRprecision.com

Features

- Emmision Modes: SSB, CW , DIGITAL
- 5W output power typ.
- Very low noise floor due to DDC input stage
- The unit has an electronic CW Iambic A/B keyer, SWR meter and output power wattmeter.
- High stability Si 570 generator
- Split-frequency operation
- PTT can be switched by connecting PTT to ground
- RX/TX switching:
  o push PTT input to ground
  o AF VOX
- Output SWR indicator
- Optimal output power indicator
- Integrated Sequencer
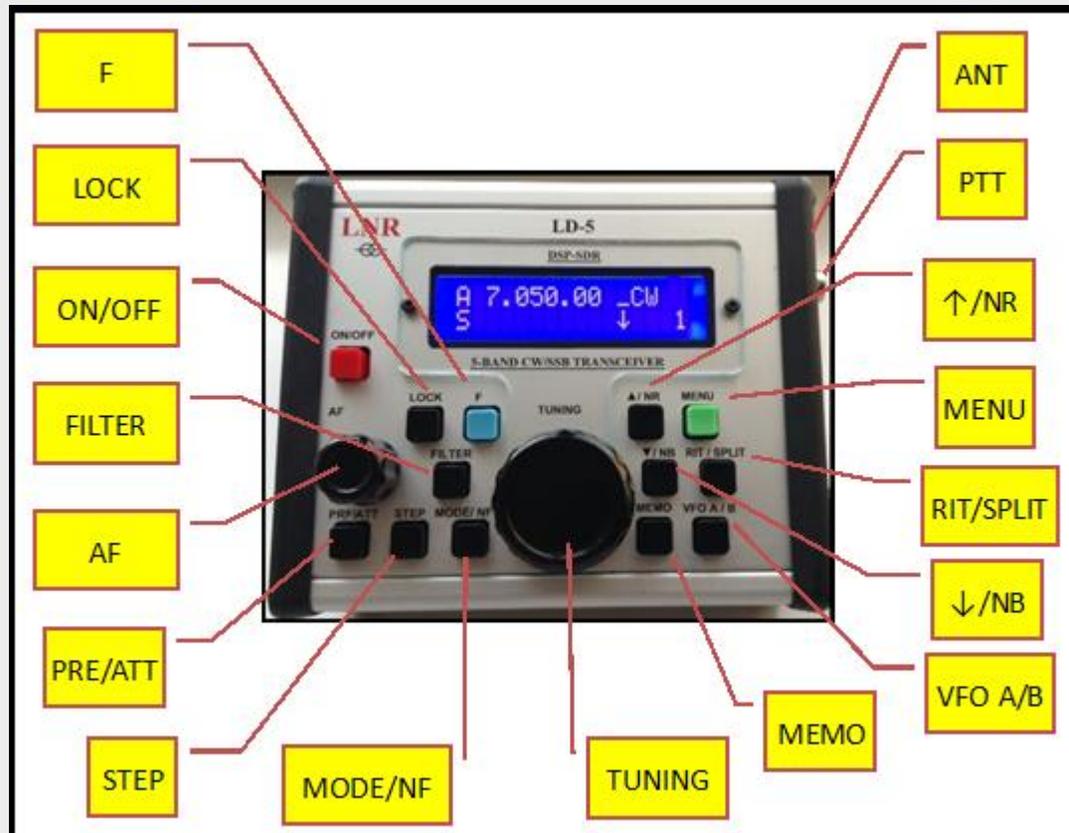- TX 3 band EQ – presets for bass, middle and treble boost
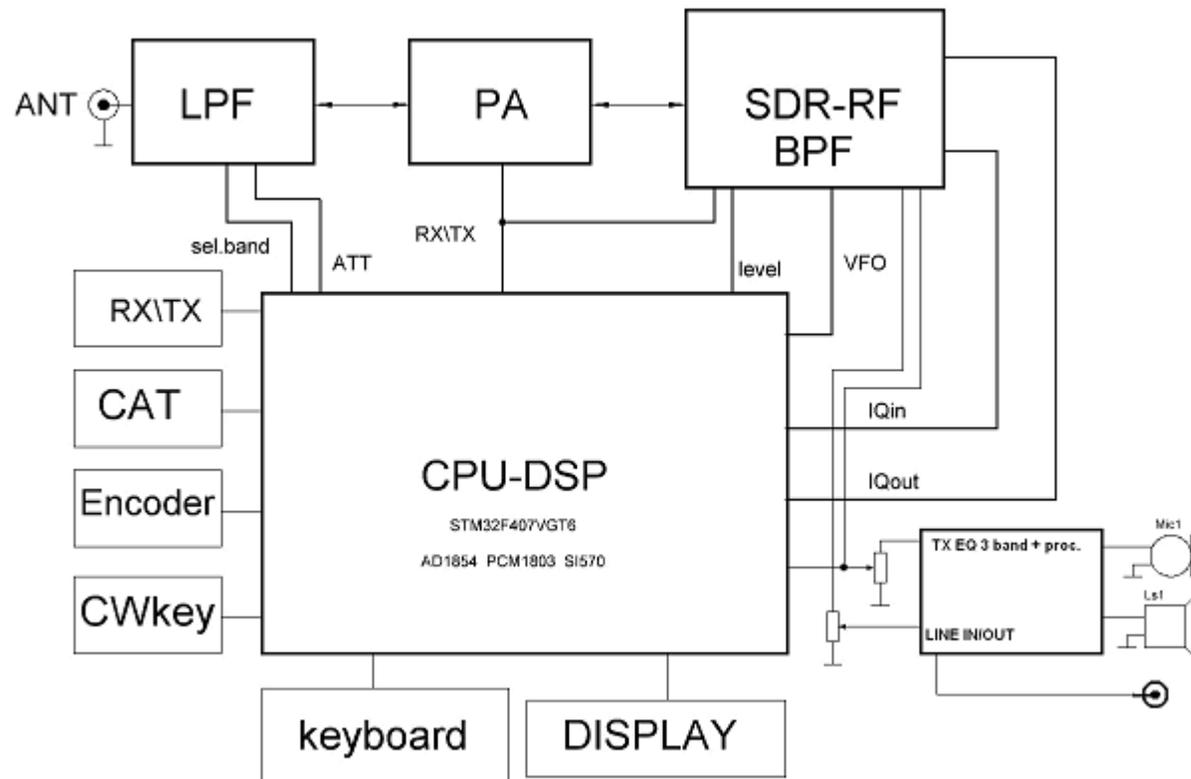
Block diagram

Specifications		
General		
Frequency range	7000 kHz – 22 MHz	40, 30, 20, 17 and 15 meter operation
Modes	USB, LSB, CW, CW-R, DIGITAL	DATA:CAT –USB jack : CW, PSK, RTTY, SSTV – 3.5mm jack
Power	5W output in CW / SSB	
Frequency Stability	+/- 3 ppm (Si570 defined) typical	

	over 0-50 deg C	
Supply Voltage	10.5V min to 15V max	350Ma receive and 1.5 to 2 A typical in transmit
Push button operation		
LO temp. Stability		+/- 2.5
Antenna	50 ohms	BNC
Dual VFO		
Memory	100 memory storage per band	Memorize frequency, mode, VFO's
Built-in speaker	0.2 watts	
Dimensions	4.724" long X 3.937" wide x 1.957 " tall	
Weight	19.0oz / 0,54kilogram /excluding microphone/	
Iambic key	mode A and mode B	
Pitch CW	Controls CW offset. The sidetone pitch is automatically set to equal the offset	
Notch Filter	Automatic Heterodyne filter for SSB from -6 to -40 db	
Noise reduction	level of attenuation of the noise from 1 to 50- use minimal necessary	
Noise Blanker	adjusted in the range from value 4 to 12 readings depending on interference	
CW VOX	Break in delay in CW – adjustable from 0.1 seconds to 5 seconds	
CW memory keyer	Choose Iambic Mode A or B	
VOICE VOX	VOX Delay adjustable from 0.1 seconds to 5 seconds	
SSB VOX LEVEL	VOX GAIN 10-100 10 IS MOST SENSITIVE	
Filters	8 different filters – 4 of 4 for CW/ SSB - 1-3 factory presets – No.4 adjustable for CW/50-1000Hz/ and SSB/250-3.6KHz	
Compressor SSB	0-20dB	
SSB TX MUTE	Enable= no monitor Disable= monitor	
Transmitter		
Input Power	10.5-13.8 VDC	
Output Power	3.5 – 8W	

Measurement	SWR and Power in numbers or bar	
	supply voltage –real voltage on display	
Two modes CW	Select a hand key or a paddle	
Receiver		
Receive sensitivity	0.2uV	Preamp
Ant Preamp	+12	dB
Spurious response rejection	IMD3 -48Db/ 5W	IMD5 -43dB
ATT	-6 db	

Front panel indicators and functions

F

LOCK

ON/OFF

FILTER

AF

PRE/ATT

STEP

MODE/NF

TUNING

ANT

PTT

↑/NR

MENU

RIT/SPLIT

↓/NB

VFO A/B

MEMO

DESCRIPTION of the command buttons
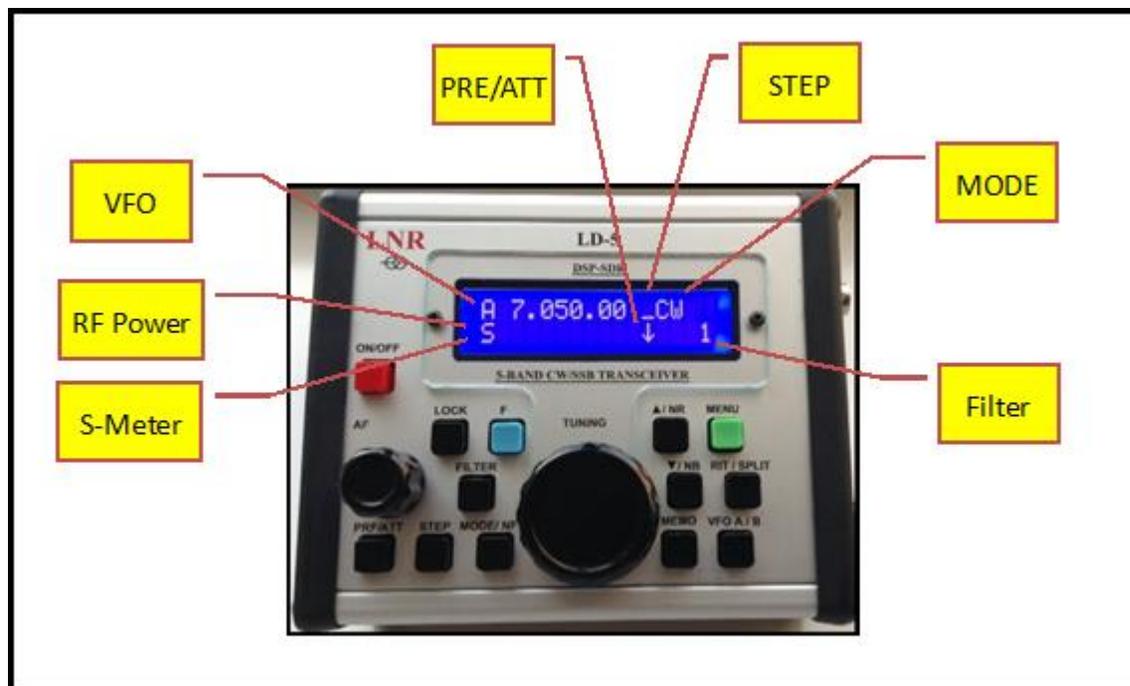
Command	Meaning
ON/OFF	POWER ON/OFF the transceiver
UP Arrow ↑	Change Band higher 7/10/14/18/21. In Menu mode select next menu item
DOWN Arrow ↓	Change band lower. In menu mode select previous menu item.
MODE	Select CW/ CWR/ LSB/ USB/DIGI
VFO	Select either VFO A or B
STEP	Sequential pressing of the STEP button or the Tuning encoder steps through the tuning rate. 1 bar- 1Hz 2 bars=10Hz 3 bars=100Hz 4 bars=1KHz tuning rate.
LOCK	Lock/unlock the tuning dial F symbol appears to the left of the mode designation on LCD

RIT	Receiver Incremental Tuning. This feature allows changing the frequency of the receiver only without effecting the transmit frequency. When RIT is activated an $*$ initially appears to the right of the frequency readout. The $*$ indicates that currently, RIT=0 or RX=TX. While RIT is activated, tuning the VFO BELOW the current frequency is indicated by a $<$ symbol. Similarly, tuning above the center frequency results in a $>$ symbol appearing to the right of the display. RIT remains active until the next ON/OFF power cycle.
PRE/ATT	Sequentially enables preamp ($\uparrow$) approx. +16dB Preamp off= No arrow attenuator ($\downarrow$) approx. -10dB
FILTER	Filter #4 is customizable in CW and SSB. CW from 50Hz$\rightarrow$ 2400Hz SSB from Low end of 250Hz to High end of 3400Hz. CW: Select Filter #4. Press F then Filter. Use the VFO knob to adjust bandwidth SSB: Select Filter #4. Press F then Filter. Use the VFO knob to adjust the low end. Press RIT to adjust the High end. Pressing RIT again will toggle back to low end adjust. Press Filter when complete.
Memory Storage	A total of 100 memories are available. All features (e.g. Mode/NB/NR/Preamp etc) are stored along with the frequency. To store a frequency in memory, first tune it in using the VFO. Set Mode and any other features you wish to store. Press MEMO Use the VFO knob to bring up the memory location you wish to store: 0-99 Press the Down Arrow $\downarrow$ Press MEMO again
Memory Recall	To recall a stored memory channel; Press MEMO Use the VFO to dial up the desired memory location Press the Up arrow $\uparrow$ Press Memo again

MENU Settings

Enter MENU MODE by pressing MENU button and exit the menu mode by pressing the MENU again after set up.
Most of the functions, related to receiving or transmitting, can be changed by values and monitored via monitor in real time.

MENU	Default menu settings
AGC	AGC speed from 1-20. 1 is the slowest and 20 the fastest
PITCH CW	Sidetone and CW offset pitch. Changes take effect when you exit Menu mode
CW SPEED	5 to 60 WPM. Speed change takes effect when you exit Menu mode.
WEIGHT CW KEY	Adjusts the ratio of dash length to dot length: 2> 1; 2.5> 1; 3> 1; 3.5> 1; 4> 1; 4.5> 1 **3:1 is standard**
CW VOX	Controls break in delay. Steps in 100mSec from 100mSec to 5 seconds
REVERSE CW KEY	Change which side of the paddle is dot and which side is dash.
CW KEY TYPE	Two options: SIMPLE= hand key. AUTO= Paddle.
IAMBIC MODE	Allows user to switch from Iambic mode A to Iambic mode B
NOTCH FILTER	Adjusts notch depth from -6 dB to -40dB Changes can be observed while in Menu mode.
NOISE BLANKER	Adjustable using tuning knob from 4 to 12. 4 is maximum blanking, 12 is minimum. Changes can be heard while in Menu mode.
NOISE REDUCTION	Menu range from 1 to 100 with 1 being the least. If NR is activated from the front panel (F + NR) you can observe the effect within the Menu.
S-METER MODE	Two modes: Bar Graph or readout in uV.
TX METER	Two options: Bar Graph (Scaler) or Watts (Number)
SHOW TX	Two options: Power in Watts or VSWR
POWER TX	Adjusts power out. Settings from 10 to 100. Typically, a 10 setting is 1W and a 100 setting is 5W
LED MODE	Two options: Forever= LCD backlight always on. Auto= backlight turns on for 3 seconds whenever a front panel switch or encoder is activated. Backlight off saves 40mA of current drain.
SSB TX MUTE	SSB TX Monitor. Two options: Enable and Disable
SSB COMPRESSOR	SSB Mic compression from 1 to 100.
SSB VOX	adjustment of VOX delay for SSB – DISABLE is off, Adjustable from 100mSec to 5 seconds in 100mSec steps
VOX LEVEL	Adjusts VOX gain in SSB mode.
TX EQ	3 options: Accentuate the Lows, Highs or Midrange. LowF /HiF/ MediumF
GAIN TX DIG	Setting from 1-9.8 using the VFO knob. This function controls the AF Gain in Digital mode
SQUELCH	Settings 0-100. A 0 (zero) setting essentially turns squelch off.

FUNCION SETTINGS = PUSHING F + :

RIT	On virtual intermediate frequency (VIF) – can be set from the main menu from 5000 to 10000 hertz. Identified as arrows on the upper right corner of the display ->. VIF is working as a main working feature and must be switched on permanently. DIRECT CONVERSION should be used as an option.

On any VFO- when you push RIT an asterisk appears as shown:

A14.020.00*_CW
S9- ===== ↑   1

When you move frequency up , an arrow will appear to the right:

A14.020.10>_CW
S9- ===== ↑   1

When you move frequency down , an arrow will appear to the left:

A14.019.90<_CW
S9- ===== ↑   1

SPLIT OPERATION	SPLIT MODE- if you want to receive on 14020.00 and transmit on 14030.00: SET frequency on VFO A 14020.00 and on VFO B 14030.00 REMEMBER, first VFO chosen is an RX frequency: PUSH RIT button, and then follow RIT MODE :

A14.020.00*_CW
S9- ===== ↑   1

PUSH VFO A/B until VFO B appears, with reflecting RX frequency arrow to the left

B14.020.00<_CW
S9- ===== ↑   1

If you switch on TX, the frequency on VFO B will appear – 14030.00

B14.030.00<_CW
PO:5.1 Watt

You will notice that VFO A frequency can move up/down, but VFO B is fixed on TX.
If you wish to reverse the frequency, exit RIT Mode and switch to VFO B, then push RIT and then VFO A.
Notice the arrow shows pointing to the right

B14.030.00>_CW
S9- ===== ↑   1

On TX you will see this :

A14.020.00> CW
PO:5.2 Watt

MENU	Press (F)unction and then Menu. This changes the 2nd line of the LCD display from S meter reading to monitoring the supply voltage. Pressing (F)unction and Menu again returns to S meter reading.
UP (↑)	Press (F)unction and then ↑ turns on Noise Reduction at whatever level is preset in the main Menu. The display will show a "R" to the left of the Filter # on the LCD display. Press (F)unction and ↑ again to turn off Noise Reduction
MODE	Available only in SSB mode. Press (F)unction and then Mode to enable the notch filter at whatever level has been preset in the main Menu. Press (F)unction and then Mode again to turn off the notch filter. The letter "N" will display to the left of the Filter #.
DOWN (↓)	Press (F)unction and then ↓ to turn on the Noise Blanker at whatever level has been preset in the main Menu. The letter "B" will display to the left of the Filter # on the LCD display
FILTER	Filter #4 is customizable in CW and SSB. CW from 50Hz→ 2400Hz SSB from Low end of 250Hz to High end of 3400Hz. CW: Select Filter #4. Press F then Filter. Use the VFO knob to adjust bandwidth SSB: Select Filter #4. Press F then Filter. Use the VFO knob to adjust the low end. Press RIT to adjust the High end. Pressing RIT again will toggle back to low end adjust. Press Filter when complete.

SERVICE MODE – It is strongly recommended to contact LNR Support before entering service mode	
Entry into service mode	To enter into default settings – switch OFF the radio and THEN power it up while F button is pressed. RADIO IS READY NOW!!!! Upon entering the service mode, reset all the settings IN DEFAULT **EXCEPT "RX IQ", "TX IQ" and fine tuning of the synthesizer. You should not go to factory settings "RX IQ", "TX IQ"** as they are set individually for your radio and precisely adjusted for values with additional specialized devices, TRANSMITTING and measuring in certain frequency.
	Each radio in the service menu is recorded INDIVIDUALY for serial number, factory settings "RX IQ", "TX IQ" and is hard to adjust if you are not aware of procedure!!!!!!!!!!

BASIC SETTINGS

F button and then press the MENU button and moving with UP / DOWN and RIT	
IF DSP	Virtual gap frequency from 5006 to 10013 Hz / recommended to use a low-frequency virtual
V PWR	Adjustment of the displayed voltage
REF VFO	Correcting the VFO frequency
MULT VFO	Divider VFO. For LD-5 = 4 / do not touch it , it is correct by the service menu/
STARTING FREQUENCY	Low end frequency of selected band; change with tuning knob
END FREQUENCY	High end frequency of selected band; change with tuning knob
S METER	Setting S-METER for the range – calibration
RX IQ	Setting the mirror channel correcting the phase and amplitude of IQ for each band separately on RX **"- minimum reading – has two modes-** fast and slow for quick setting and fine – switched with STEP. **Each transceiver is factory default recorded on the accompanying document**
FILTER SSB	Setup filters from 1 to 3 for each type of work. Changing the filter with the push button "Filter"
FILTER CW	Allows user to change the bandwidth of the first three CW filters. While in Service Mode, press Menu. Select Filter 1 CW and redefine the BW with the main tuning knob. Step to the next filter by pressing FILTER etc. Exit Menu mode to save.
AGC DSP	on / off AGC -**SHOULD ALWAYS BE SET TO ENABLE**
SHOW S METER	Switches S meter
FILTER TX SSB	Adjustment of bandwidth in the transmit mode /FROM 150 Hz to 3600Hz/ -. Changing adjustment of the upper frequency
FILTER TX CW	With the push button "RIT/VIF" adjustment of bandwidth in the transmit mode /FROM 50 Hz to 1000Hz/ - soft CW manipulation 50 – 180 Hz. BELL SOUND
LEVEL TX	Adjustment of Power – entries are shown from **"Power TX"-** First row on Display: TX ADC indications power "when all bands are equal in power".

DESCRIPTION of the settings in transmit mode

| PWR / VTT	
POWER TX	First row on Display: TX ADC indications power for each band separately. Second row on Display : Power Control for each band separately, shows power of radio on TX – use forward wave of SWR meter settings are made on a 50 ohms dummy load and SWR = 1, setting indication varies around 100 – 4000
TX IQ	Correcting amplitude and phase balance in IQ channel – in the transmit mode for each band separately For this purpose we need to have a separate receiver on the frequency and listen to the unwanted side band channel – set on minimal hearing. Factory setting on all bands is : A 0.0000 F 0,0000
TX EQ	3 band audio presets on transmit only: bass, middle. Treble boost

DESCRIPTION of the current settings

/ Those settings are directly accessible by pressing MENU /	
AGC SPEED	ADJUSTABLE in levels of delay from 1 to 20
PITCH CW	CW tones from 400 to 1000 Hz when crossing the transmit shift to the same tone
NOTCH FILTER	Reject interfering tone only for SSB from -6 to -40 db
NOISE BLANKER	Adjusted in the range from value 4 to 12 - readings depending on interference
NOISE REDUCTION	Level of attenuation of the noise from 1 to 50- use minimal necessary
S-METER MODE	Shows scale bars or S-units in microvolt's
LED	Backlight brightness of the LCD from 0 to 250
CW SPEED	Regulating the speed of the automatic key from 20 signs to maximum
WEIGHT CW KEY	Dot-dash ratio 2.5> 1 to 4.5> 1 in 0.5
CW VOX	DELAY mode in CW - 100 milliseconds to 5000 milliseconds / 5 seconds /
COMPRESS TX	Compression microphone from 0 to 100%
REVERSE CW KEY	Reversing dot-dash to paddle
TX METER	Shows SWR or power in the transmit mode with bar graph or scale figures
SHOW TX	SWR or power to be displayed in the transmit mode
POWER TX	Regulation in mW from 10% to 100%
LED MODE	Mode for backlight LCD - constant or relight by pressing any button or rotating of tuning knob
SSB MUTE	on / off microphone - MONITOR mode in transmit

DIGITAL MODES
IMPORTANT – Make sure to connect the USB, Power Cord and Antenna before powering on the radio. Then Power ON the Radio. Finally, start up your software program:

In order to operate digital mode or interface with computer, utilize the Line IN/OUT jack and cable. The radio has typical levels for audio signals similar to other amateur radios.
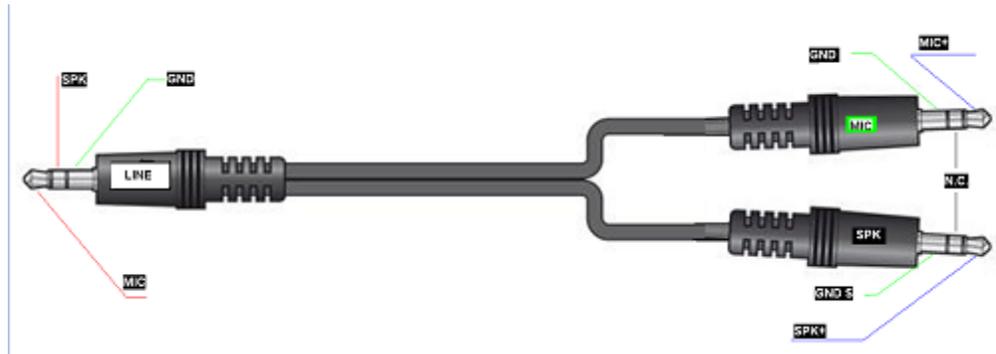
SWR Protection

The radio has a built-in ALC SWR protection - when SWR does not exceed 1:3 – there is no change in output power.
 But at a greater SWR, the protection gradually lowers the power output, and at SWR = 10 – the output power is only 1%.

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EXPANDED RECEIVE CAPABILITIES

The LD-5 can be set to receive 160M and 80M. At this time, this is for receive only, no TX.

1. Put the LD-5 on 40M.
2. Enter Service Menu
3. Use the UP and DOWN arrow keys to bring up (Begin Frequency 2 Band)
4. Using the VFO knob to tune to 1.8MHz. Pressing the Step button will enable faster QSY.
5. Exit Service mode
6. Use the VFO knob to tune to 7.300MHz and as you go higher the VFO will roll over to 1.8MHz.
7. Select a frequency and mode on 160M and store this frequency into a memory location.
8. Tune up to 80M and do the same for a memory location.
9. Tune to 40M and store a memory location.

When the 40M band is selected with the UP and DOWN arrows, use the Memory function to recall 160, 80 or 40M bands.