Rotronix Ltd.

Software-Hardware-Design

Version 01-02

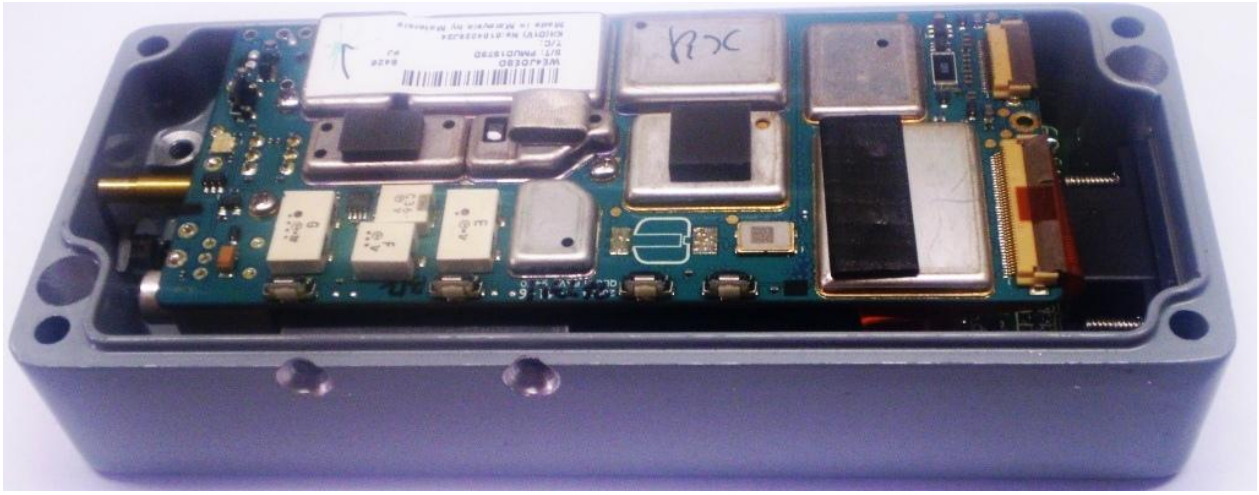
LC828 Professional Portable Radio-Module Manual©

Table of Contents:

1 Summary:

The LC828 Radio-Module is a modified MOTOROLA Professional Portable Radio under control of a Rotronix Ltd. PROIS interface-board (IOB151208).
The standard operation voltage is 7.5 Volt. Adding a optional custom-made switch-mode power-supply will change the operation voltage from 11 to 28 Volts.
Provision is made on the PROIS Interface-board for additional option-boards, e.g. a multi-frequency CTCSS board.
Features not found in the standard radio are:

- Adjustable Transmit hang timer.
- Low battery voltage alarm utilizing a DTMF tone on the tail of the transmitter.
- Special scan.
- Linking option.
- One-wire TX/RX audio.
- Flat TX/RX (selectable).



Portable Radio with PSU and PROIS option board in die-cast housing

2 Introduction:

This manual provides information about the LC828 radio-module. The LC828 radio-module is based on a modified Motorola Professional Portable Radio, with a PROIS interface-module (Part No: 1202899J28) and a power-supply all mounted in a die-cast housing. This makes a universal low current transmit/receive module compliant with most regulatory acceptance requirements.
The radio utilizes the Analogue Frequency Modulation Scheme.

2.1 Associated Propriety Documentation:

Motorola service manual: (Part No: 6804110J64-H)
Motorola PROIS 2.03 Manual
Motorola PROIS 2.03 Electrical Manual: (Part No: 1202899J28)
Rotronix Ltd DC-DC converter manual (Part No: PSU-322859©)
Rotronix Ltd LC828 interface-module Manual (Part No: RTRNX-GP328-V4)
Rotronix Ltd Professional Portable Radio Interface Option-Board Manual (Part No: IOB151208) ©

2.2 Supported Portable Radios:

PRO5150, PRO5350, GP140, GP318, GP328, GP328 LS, HT750, HT750.LS, MTX850LS, HT1250, HT1250.LS+, MTX8250LS, PRO7150, PRO7350, GP338, GP338 LS, PRO9150, HT1550XLS

2.3 Publication Record:

Issue	Publication Date	Author	Description
1.01	January 2009	Hans de Roode	First issue

2.4 Alert Notices:

Within this manual, four types of alerts are given to the reader: warning, caution, important and note. The following paragraphs illustrate each type of alert and its associated symbol.

Warning!!

This alert indicates a potential risk of death or serious injury.

Caution

This alert indicates a risk of minor or moderate injury to people.

Important

This alert indicates the risk of equipment damage or malfunction.

Note

This alert highlights information that is required to ensure that procedures are performed correctly.

2.5 Contact details:

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2.6 Copyright:

2.7 Abbreviations

Abbreviation	Description
3DK	Third-Party Developer's Kit
ASCII	American Standard Code for Information Interchange
AVL	Automatic Vehicle Location
CCRI	Computer Controlled Radio Interface
CRC	Cyclic Redundancy Check
CTCSS	Continuous Tone Coded Squelch System
CTS	Clear to Send
DCE	Data Circuit-Terminating Equipment
DCS	Data Carrier System
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
FEC	Forward Error Correction
FFSK	Fast Frequency Shift Keying
GPIO	General Purpose Input/Output
IPN	Internal Part Number
LED	Light-Emitting Diode
MSD	Most Significant Digit
MPPR	Motorola Professional Portable Radio
NMEA	National Marine Electronics Association standard. Combined electrical and data specification for communication between marine electronics and GPS
IOB	Interface Option Board
PC	Personal Computer
PTT	Press To Talk
PCB	Printed Circuit Board
PROIS	Motorola proprietary Professional Radio Option Interface Specification
RMC	Recommended Minimum sentence C. NMEA GPS message type for the minimum recommended
RTS	Request to Send
Rx	Receive mode
RXD	Receive Data
SDM	Short Data Message
SMC	Switched Mode Converter (12 to 7.5V)
TX	Transmit mode
TXD	Transmit Data
UART	Universal Asynchronous Receiver-Transmitter
XON	Data Transmitter On
XOFF	Data Transmitter Off
ZIF	Zero Insertion Force Connector

2.8 Model-Chart:

Radio-Module Model:	Frequency-Range
LC828/VHF-low 4/10	4 or 10 channels within 136 – 160 MHz
LC828/VHF-high 4/10	4 or 10 channels within 150 – 179 MHz
LC828/UHF-low 4/10	4 or 10 channels within 403 – 470 MHz
LC828/UHF-high 4/10	4 or 10 channels within 470 – 520 MHz

Other models are available on request.

2.9 Specifications:

The VHF radios have been tested and approved under the following Base-Station standards:

- Euro, includes EM Compliance testing.
- FCC
- Australian Standards 2945

The UHF radios are pending approval.

2.9.1 TRANSMITTER:

Freq. Stability (-30°C to +60°C): 0.00025%.

VHF TX power:	5 Watt adjustable.
UHF TX power:	4 Watt adjustable.
Channel bandwidth:	12.5, 20 or 25 KHz.
Transmit-audio level	0 dBm for full system deviation. (adjustable).
Spurs/Harmonics:	-36 dBm < 1 GHz. -30 dBm > 1 GHz.
FM Noise:	-40 dB.

2.9.2 RECEIVER:

Sensitivity	12dB EIA SINAD: 0.35 µV.
Receive-audio level	0 dBm.
Selectivity	Adjacent Channel Selectivity ETS -60 dB.
Intermodulation	ETS -65 dB.
Spur Rejection:	-70 dB.
Image Rejection:	-70 dB.

2.9.3 DC-POWER:

Without the DC-DC power supply (Part No: PSU-322859©), the LC828 radio module works on 7.5 Volt, (+/- 20%) the stand-by current is 50 mA. Transmit current (full TX power) 1.7 Amp.
If the radio is used for receive only, than the radio can be powered with the 7.5Volts from the option-board which is derived from the Transmit radio.

2.9.4 DC-DC CONVERTER POWER SPECIFICATIONS:

The LC828 module draws the following currents with the DC-DC converter fitted:

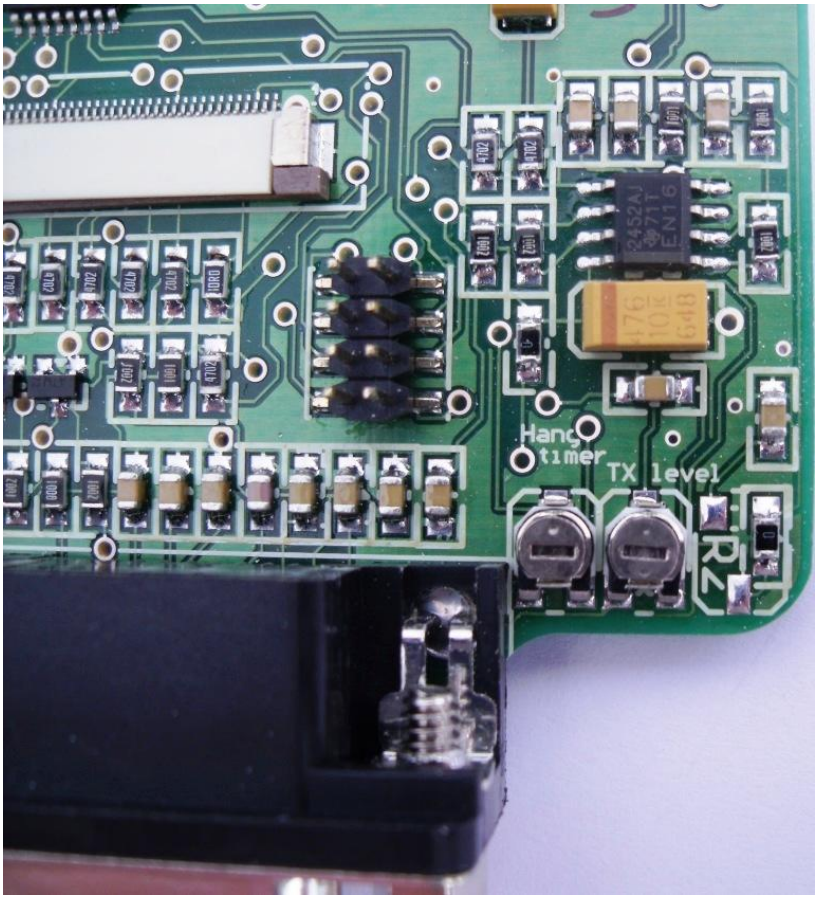
Input Voltage	Current RX (mA)	Current TX (A)	Current Repeater RX (mA) + LED
11	54	1.3	113
12	51.7	1.2	106
13	48	1.1	99
14	47	1	95
15	45	0.96	92
16	44	0.91	90
17	43	0.86	87.5
18	42	0.82	86
19	41	0.77	85
20	40	0.73	78
21	37	0.70	74
22	35.4	0.67	72
13	34	0.65	68
24	33.5	0.63	66.4
25	32	0.62	65
26	31	0.58	63
27	30	0.57	62.5
28	29.6	0.55	62

3 Technical outline:

3.1 controls:

The IOB has three adjustable potentiometers:

1 VR1, sets the TX-tail, (0 to 2 sec).
2 VR2, Audio output-level (replaced with 0 ohm resistor).
3 VR3, Audio input-level (TX audio).



3.2 Connectors:

The Main Connector (J3) is of the type D-shell, 9 pin plug.

Pin:	Description:
1	GND
2	7.5V (max. 500mA out)
3	RX/TX audio
4	3.3V (reference)
5	Channel select input
6	PTT
7	RX busy out
8	Power supply
9	Power supply
shell	GND

3.2.1 RF-Connector:

The antenna-connector is of the type SMA socket, and has an impedance of 50 ohm.

3.2 LED:

The LC828 uses the standard radio LED, brought to the outside of the die-cast box by a light-tunnel.
Modifying the LED functions is done trough the radio CPS.
The LED indicates the following:

Event:	LED	Indication
switch-on:	Green flash	OK
	Red flash	Radio Error
Receiving:	Flashing Red	Invalid CTCSS
	Green	valid signal
Transmitting:	Solid Red	transmitting
	Flashing Red	low battery
Stand-by	Solid Green	scanning

3.2 Channel change:

A voltage on J3.5 will select a channel. The voltage can be in the range of 0 to 3.3 Volts (reference is J3.4). Channel selection is according to the following table:

Channel selected:	Voltage J3.5:
1	3.3
2	3
3	2.7
4	2.4
5	2.1
6	1.8
7	1.5
8	1.2
9	0.9
10	0.6
4	0

5.0 Dimensions:

Width mm:	150
Height mm:	64
Depth mm:	36
Material:	Enclosure and lid made from cast-aluminum, lid with neoprene cord seal.
Surface finish:	Powder coated in RAL 7001
Weight:	475 grams.

Mounting holes are under the lid, diameter 5mm.