User Manual

For CT100

- when it has to be right

29. Aug. 2012

CONFIDENTIAL

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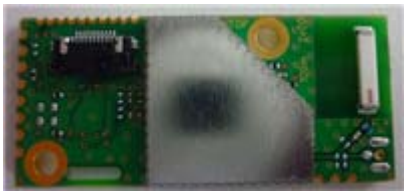
1 INTRODUCTION



The CT100 radio facilitates a IEEE 802.15.4 based radio communication. It uses a proprietary wireless communication stack to implement a star or cluster network with multiple nodes communicating simultaneously.

The radio module provides three basic functions:

- Transparent communication between network node and network coordinator
- Writing parameters to the radio module for configuration to determine its mode of operation such as the configuration of a node or coordinator
- Reading parameters from the radio module

All communication to the radio module is established through a UART communication interface.

2 ELECTRICAL INTERFACE

2.1 Maximum Ratings

Rating	Min.	Max.	Unit
Input Voltage VCC	-0.3	3.6	V
Input Current VCC		150	mA
Operating Temperature	-30	60	°C

2.2 Operating Conditions

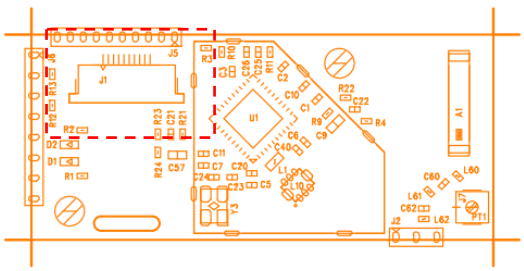
Rating	Min.	Typ	Max.	Unit
Input Voltage VCC	2.1	3 / 3.3	3.6	V
Operating Current at 3dBm	-	30	-	mA
Maximum RF Output Power			7	dBm

2.3 Connector

The radio module is connected through a 10-pin 0.5mm pitch flat cable on connector J1:

Main function	I/O	10-Pin	Description	Comment
VCC		1	Power Supply 3 / 3.3 V	
VCC		2	Power Supply 3 / 3.3 V	
GND		3	Ground	
GND		4	Ground	
GND		5	Ground	
UART TX	O/O	6	UART TX (Out)	High impedance if in shutdown.
UART RX	I/I	7	UART RX (In)I	High impedance if in shutdown.
RTS	O/I	8	Not used	Option SW implemented, wired to corresponding hardware pin on uC. High impedance if in shutdown.
CTS	I/I	9	Not Used	Option SW implemented, wired to corresponding hardware pin on uC. High impedance if in shutdown
SHUTDOWN	I	10	Enable sleep mode	Shutdown or sleep mode, to be able to select multiple radio modules

The location of connectorJ1 is indicated below. To provide cable relief a slot is integrated into the radio module.



3 UART CONFIGURATION

Baudrate	Data Bits	Stop bits	Parity	Flow Control
19200	8	1	No	No

4 MODULE MOUNTING

The CT100 radio module can be mounted with two 2.5mm machine screws. It is preferred that the screws and stand offs are made of a non conductive and non-ferromagnetic material such as plastic or ceramics.

Alternatively the module can be directly soldered on to a carrier board utilizing the radio module using connector J2 and J6.

5 RADIO MODULE COMMAND SET

The following table lists all commands available to the user through the UART communication.

Ref.	Group	Command	Response	
1	Test	0/TEST/CW/n	0/OK 0/ERR	Generate CW Signal for Test with TX power of n-0x80 dBm. Test function for EMV measurement
2		0/TEST/RND/n	0/OK 0/ERR	Generate random Signal for Test with TX power of n-0x80 dBm. Test function for EMV measurement
		0/TEST/DUTY/hh	0/OK 0/ERR	Set 'ON' time in ms for test signal. Total duty cycle period is 100ms. Minimum is 10 (0x0A). Maximum is 100 (0x64)
3		0/TEST/CH/n	0/OK 0/ERR	Force module to channel n
4		0/TEST/LOOP	0/OK	Enable / disable UART Loop back
5		0/TEST/END	0/OK 0/ERR	Finish any test mode. An error is generated if no test signal is active.
6		0/TEST/HIST	0/Assert: hhhh 0/Assert: HHHH/HHHHHHHH 0/Assert: hhhh 0/Assert: HHHH/HHHHHHHH ….	Get Assert-History hhhh: Assert counter (hex) HHHH: file number HHHHHHHH: Line number
7		0/TEST/VER	0/VER/hhhhhhhh/ hhhhhhhh	Get VersionNumber of SW and WPS (High word/Low word)
8		0/TEST/BUILD	Not defined	For debug purposes. Returns build and revision information
9		0/TEST/INFO	Not defined	For debug purposes
10		0/TEST/RX	0/RX/hh	Get current RX level
11		0/TEST/FREQ	0/OK 0/ERR	Output a frequency signal to verify internal frequency. The uC must be reset after this command.
12	State	0/STAT/RX/n	0/RX/n/nn	Get Rx Level of last frame from device n. P= nn-0x80 dBm
13		0/STAT/PER/n	0/PER/hhhhhhhh	Get Packet error rate of connection to device n
14		0/STAT/RPER	0/OK	Reset all Packet error rate counters
15		0/STAT/INFO	0/INFO/hhhhhhhh	Get radio module info (mode, power, type,) The lowest 8 bits are the maximum tx power in dBm + 0x80
16		0/STAT/CH	0/CH/hhhh	Get current channel
17		0/STAT/SLEEP	0/OK 0/ERR	Radio module is forced to sleep as soon as the WPS is idle.
18				
19	Config	0/CONF/FTR/n/hhhhhhhh	0/OK 0/ERR	Set filter value 0xhhhhhhhh for filter / address n. Also used to configure the radio module itself (with n = 0)
20		0/CONF/FTR/n/	0/FTR/n/hhhhhhhh	Get filter value
21		0/CONF/TXP/xx	0/OK 0/ERR	Set power-limit in dBm any value that is in physically possible range is allowed
22		0/CONF/TXP	0/TXP/xx	Get. Max Power

23		0/CONF/DEV/n	0/DEV/n/none 0/DEV/n/hhhh	Get WPS address of device that is paired on filter structure n
24		0/CONF/CH/hhhh	0/OK 0/ERR	Set allowed channel with bitmask 0xhhhh
25		0/CONF/CH	0/TXP/hhhh	Get allowed channel bitmask
26		0/CONF/LL/n	0/OK 0/ERR	Set Live Line target to filter n. Setting is stored in Flash
27		0/CONF/RSTLL	0/OK 0/ERR	Reset any set LL target. Setting is stored in Flash
28		0/CONF/BAUD/x	0/OK 0/ERR	Response is sent with old baud rate. Baud rate must be given in hex.
29		0/CONF/TIMLL/x	0/OK 0/ERR	Set Live Line repetition time to x. x =1 means 10ms.
30		0/CONF/GAIN/h	0/OK 0/ERR	Set the LNA gain of the PA on the 300m Radio h=0: low gain; h=1: high gain
31		CR/LF	0/READY	May be used to wake up from sleep mode
32	Pairing	0/PAIR/START	0/OK 0/ERR	Start pairing with new network (only for Remote / Receiver)
33		0/PAIR/ALLOW	0/OK 0/ERR	Allow pairing of new device (only for coordinator/Laser)
34		0/PAIR/STOP	0/OK 0/ERR	Stop pairing for new devices (only for coordinator/Laser)
35	Events	---	0/LOST/n	Live line connection lost with device, that is paired to filter n
36			0/FOUND/n	Live line connection reestablished with device, that is paired to filter n
37		---	0/CH/hh	Radio switched to new channel
38		---	0/OK	Send data successful
39		---	0/FAIL/n	Send data failed
40			0/UNKNOWN	Unknown command for device 0
41			0/MISSING	This command is missing/ not implemented
42		---	0/PAIR/n	Paired new Device to filter n
43		---	0/READY	The radio module is ready to receive data via UART or transceiver after sleep mode or power-up.
44		---	0/WPS/hhhh 0/WPS/hhhhhhhh	The WPS crashed. This event occurs twice. The first error gives the file number and the second gives the line nr that caused the crash.
45	norm. addr.	n/_____	nothing	Normal addressing can be used to send data to a Viper device that is paired to a filter structure. The address specifier has to consist of 1 hex digit.
46	Ext. addr.	nnnn/_____	nothing	Extended addressing can be used to send data to a specific WPS address. The address specifier has to consist of 4 hex digits.

6 RADIO MODULE CONFIGURATION

The radio module can be configured through filters using the command 0/CONF/FTR/n/hhhhhhhh, whereas n indicates the filter number and h the filter bit mask. Each filter corresponds to a node in the network where as filter 0 is reserved for the radio module configuration. Each bit in the mask has a dedicated function:

Bit range	Bitmask	Value	Description
31-24 (Manufacturer Type)	31		Leica Device
	30		Reserved (may be set to '1')
	29		Reserved (may be set to '1')
	28		Reserved (may be set to '1')
	27		Reserved (may be set to '1')
	26		Reserved (may be set to '1')
	25		Reserved (may be set to '1')
	24		Reserved (may be set to '1')
23-16 (Device Type)		0x11	Coordinator
		0x12	Node 1
		0x13	Node 2
		0x14… …0xFE	Node 3
		0xFF	Alll devices
14-15	15		Reserved
	14		Reserved
11-13 (Range Type Mask)	13		Reserved
	12		300m
	11		100m
4-10			
0-3 (Device Number)		0x0… …0xE	Reserved
		0xf	All device numbers are allowed

The following section shows a example of UART configuration and pairing process:

Configuration of Node 2
0/CONF/FTR/0/80135001<CR><LF> // Configure Node 2
0/CONF/FTR/1/8011D800<CR><LF> // Configure channel to communicate to coordinator

Configuration of Coordinator
0/CONF/FTR/0/80110000<CR><LF> // Configure Coordinator Device number must be 0
0/CONF/FTR/2/8013D801<CR><LF> // Configure channel to communicate to Node 2

Pairing Start
0/PAIR/ALLOW<CR><LF> // Allow to pair with node

Pairing of Receiver
0/PAIR/START<CR><LF> // Initiate pairing procedure

Sending data from Node 2 to coordinator
2/Send this string to coordinator<CR><LF>

7 CERTIFICATION

7.1 FCC Certification

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: XYZMODEL1” or “Contains FCC ID: XYZMODEL1.” Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.