RAMP-AC RF DVK Hardware

User's Guide

Version 1.0

global solutions: local support™
Americas: +1-800-492-2320 Option 2
Europe: +44-1628-858-940
Hong Kong: +852-2923-0610
wireless.support@lairdtech.com
www.lairdtech.com/ramp

REVISION HISTORY

Version	Date	Changes
1.0	30 April 2014	Initial Release

CONTENTS

INTRODUCTION

The Laird RF RAMP-AC Development Kit board is the standard interface for software development on all Laird RAMP-AC products. This board is connected to a Windows PC via RS-232 connector and programmed via the Laird Configuration Utility. This guide covers the hardware specifications of the development board,

HARDWARE

This section details the Development Kit boards for the AC series RAMP modules including the following:

AC4490-1000M AC4490-200M AC4490LR-1000M AC4490LR-200M AC4490-200A	AC4790-1000M AC4790-200M AC4790LR-1000M AC4790LR-200M AC4790-200A	AC4486-5A AC4486-5M	AC5124 – EOL AC3124 – EOL AC4424 – EOL AC4868 - EOL

AC Series DVK Board

The SDK board is provided so the developer can use a standard PC interface to operate the transceivers and to aid in system integration. As shown in Figure 1, there are many features that enhance the functionality and usability of this board. It uses +5V TTL, RS232, RS485, and USB data formats for interfacing with the transceiver. The configuration and operation of the SDK board is continuously shown by the LEDs located on the edge of the board. See Table 1 and Table 2 for definitions of the LEDs and switches.

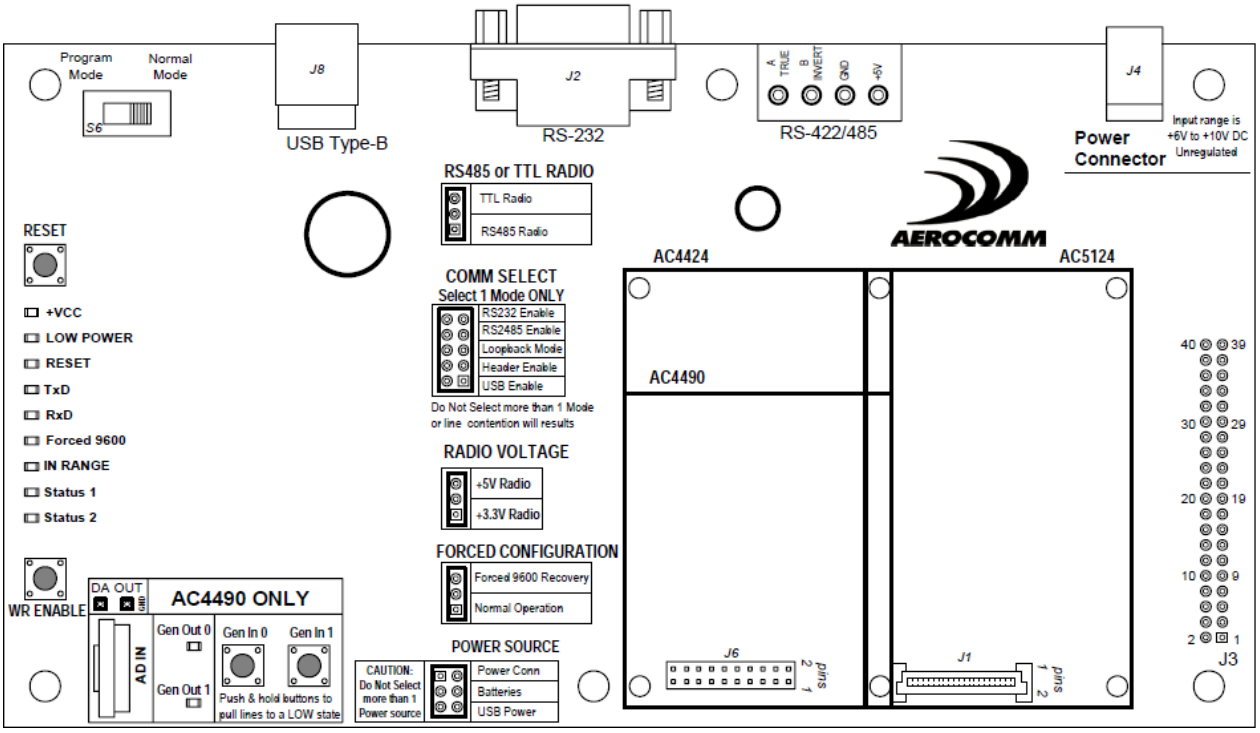

Figure 1: SDK Board Assembly Drawing

Table 1: Switch and Jumper Settings

Switch / Jumper	Description
Program Mode/ Normal Mode (S6)	When this switch is moved to the Program Mode position, the RTS pin from the DB9/USB connector is connected to the Command/Data pin (AC4490, AC4486, AC4424, AC4790, AC4868), the TE pin (AC3124, AC1524) and the Pktmode pin (AC5124) of the transceiver. RTS of the transceiver is also connected to GND which allows the SDK software to control these pins with RTS always enabled. When the switch is moved to the Normal position, RTS at the DB9/USB connector is connected to RTS pin of the transceiver and Command/Data is left disconnected. The AC4424, AC4490, AC4790, AC4486, and AC4868 families all support AT commands for making changes to the EEPROM settings. If the *Read/Write with AT Commands* checkbox is enabled on the PC Settings page of the configuration software, then the Program/Normal switch can be set to Normal. The AC5124 family also supports AT Commands when that function is enabled in the transceiver EEPROM.
RESET (S1)	When this button is pressed, the transceiver hardware performs a soft reset.
WR ENABLE (S2)	When this button is pressed, it takes the Write Enable pin (AC4424, AC5124, AC3124, and AC1524) or GI1 pin (AC4490, AC4486, AC4790, AC4868) low. **Note:** This button must be pressed and held during the write process for AC5124, AC3124, AC1524, and AC4424 product families.
RS485 or TTL Radio	If using a transceiver module fitted with a RS-485 interface chip, select the RS485 Radio. This converts the transceiver's RS-485 interface to serial, which is then converted to the interface selected by the COMM SELECT jumper. If not using a transceiver module fitted with a RS-485 interface chip, select the TTL Radio.
COMM SELECT (J12)	When this jumper is moved to the RS232 Enable position, RS-232 communication is enabled through the DB9 connector (J2). When this jumper is moved to the RS485 Enable position, RS-485 communication is enabled through the RS-485 header pins. When this jumper is moved to the Loopback Mode position, the transceiver TxD pin is tied to the transceiver RxD pin. This is only valid for AC5124, AC4424, AC4486, AC4490, AC4790, and AC4868 products. RTS mode must be disabled on the transceiver when Loopback Mode is enabled. This is incompatible with RS485 Radio selection. When this jumper is moved to the 40 Pin Header position, serial communication is enabled through the 40 pin header (J3). Depending on the transceiver used, signal levels must be either 3.3V or 5V. When this jumper is moved to the USB Enable position, USB communication is enabled through the USB Type B connector (J8).

Switch / Jumper	Description
RADIO VOLTAGE (J9)	If this jumper is moved to the +5V Radio position, the transceiver is powered with 5V. If this jumper is moved to the +3.3V Radio position, the transceiver is powered with 3.3V. The AC4x90-1000, AC4868 and AC4x90-1x1 must have this jumper set to 3.3V. **Note:** Special care should be taken when setting this jumper. An improper setting can cause catastrophic damage to the transceiver.
FORCED CONFIGURATION (J11)	When this jumper is moved to the Normal Operation position, the transceiver communicates at the Baud Rate configured in the EEPROM. When the jumper is moved to the Forced 9600 Recovery position, the transceiver interface baud rate is forced to 9600 Baud upon reset. This is for EEPROM recovery only and should not be used in normal operation.
POWER SOURCE (J7)	When this jumper is moved to the Power Conn position, power is supplied to the SDK board through the power connector (J4). When this jumper is moved to the Batteries position, power is supplied to the SDK board through the two AA battery sockets on the bottom of the SDK board. **Note:** Special care should be taken when selecting batteries to power the SDK. **High quality Alkaline batteries should be used.** Do not mix battery types or batteries that have been used unequally as performance could suffer. Four Alkaline batteries produce a voltage of 6V. A minimum of 5.5V is required to power the SDK board. Power should be constantly monitored when using battery power. If USB Power is selected, the transceiver and development board receive power from the USB port. USB power should only be used for AC4486, AC4490, AC4790, and AC4868 product families. Most USB ports can only supply 500 mA of power max therefore it is recommended that USB power only be used with transceivers that draw less than 300 mA peak. **Note:** Though PCs should have over-current protection for their USB ports, drawing too much current through the USB port can cause damage to the PC and should be avoided.

Table 2: Status LEDs

LED	Description
+VCC	Lights when power is applied to the serial adapter board.
LOW POWER	Monitors the 5V supply and lights when the supply dips below 4.8V.
RESET	Lights when the reset line to the processor is high, resetting the transceiver.
TxD	Lights when TXD line is low; a rapid flash occurs when data is sent from transceiver to host.
RxD	Lights when RXD line is low; a rapid flash occurs when data is received by transceiver from host.
Forced 9600 Recovery	Lights when 9600 Baud line is low; shows the FORCED CONFIGURATION jumper is set to force transceiver to 9600 Baud. The transceiver must be reset before it is forced to 9600.

LED	Description
IN RANGE	With a client transceiver, it lights if the client transceiver is in range of a server transceiver with the same system ID and channel number. With a server transceiver, it always lights when the server is powered in normal mode and is ready to accept data.
Status 1	Reflects the state of the Command/Data pin (AC4490, AC4486, AC4424, AC4790, AC4868), the TE pin (AC3124, AC1524) and the Pktmode pin (AC5124). This is controlled by the PC RTS pin when the Program Mode/Normal Mode switch is set to Program Mode. Lights when this pin goes low.
Status 2	Lights when the Write Enable pin (AC4424 / 5124/ 3124 / 1524) or GI1 pin (AC4490 / 4486 / 4790 / 4868) goes low. Controlled by WR ENABLE and Gen IN 1 buttons.

Table 3: AC4490 Only Section (AC4486, AC4790, and AC4868 Included)

Item	Description
Potentiometer/AD In	This varies the voltage (0 – 3.3V) presented to the AD In pin (pin 18).
Gen Out 0 LED	Will light when the GO0 pin (pin 1) is *Low*.
Gen Out 1 LED	Will light when the GO1 pin (pin 9) is *Low*.
Gen In 0 Pushbutton	When depressed, will force the GI0 pin (pin 4) *Low*.
Gen In 1 Pushbutton	When depressed, will force the GI1 pin (pin 14) *Low*.
DA_Out	This probe point provides a location for measuring the DA_Out pin (pin 19).
GND	This probe point provides a GND reference location.

Table 4: DB9 (J2) Signal Definitions

J2 Pin#	J1 Pin#	Signal Name	Description	Direction
1	36	DCD	Data Carrier Detect	I
2	14	RXD	Receive Data	I
3	16	TXD	Transmit Data	O
4	34	DTR	Data Terminal Ready	O
5	1,20,21,40	GND	Ground	
6	32	DSR	Data Set Ready	I
7	27	RTS	Request To Send	O
8	23	CTS	Clear To Send	I
9	19	RI	Ring Indicator	I

Note: I/O direction is relative to the PC.

Table 5: SDK Board to Transceiver Pin Definitions

J1 Pin #	Type	AC5124 Pin #	AC5124 Signal Name	AC1524 AC3124 AC4424 AC4490 AC4486 AC4868 Pin #	AC1524 AC3124 Signal Name	AC4424 Signal Name	AC4490 AC4486 Signal Name	AC4790 Signal Name	AC4868 Signal Name
1	GND	1	GND	5	GND	GND	GND	GND	GND
2	I	2	PKTMODE	17	TE	Command/ Data	Command/ Data	Command/ Data	Command/ Data

J1 Pin #	Type	AC5124 Pin #	AC5124 Signal Name	AC1524 AC3124 AC4424 AC4490 AC4486 AC4868 Pin #	AC1524 AC3124 Signal Name	AC4424 Signal Name	AC4490 AC4486 Signal Name	AC4790 Signal Name	AC4868 Signal Name
3	VCC	3	VCC	10	VCC	VCC	VCC	VCC	VCC
4	NC	4	NC		NC	NC	NC	NC	NC
5	VCC	5	VCC		NC	NC	NC	NC	NC
6	NC	6	NC		NC	NC	NC	NC	NC
7	NC	7	NC		NC	NC	NC	NC	NC
8	NC	8	NC	19	NC	NC	DA Out	NC	DA Out
9	NC	9	NC		NC	NC	NC	NC	NC
10	NC	10	NC		NC	NC	NC	NC	NC
11	O	11	RSSI	13	RSSI	RSSI	RSSI	RSSI	NC
12	NC	12	NC		NC	NC	NC	NC	NC
13	NC	13	NC		NC	NC	NC	NC	NC
14	O	14	TXD	2	TXD	TXD	TXD	TXD	TXD
15	O	15	In Range	20	In Range	In Range	In Range	Session Status	In Range
16	I	16	RXD	3	RXD	RXD	RXD	RXD	RXD
17	I	17	RI_In		NC	NC	NC	NC	NC
18	NC	18	NC		NC	NC	NC	NC	NC
19	O	19	RI_Out	9	NC	NC	GO1	GO1	GO1
20	GND	20	GND	18	RE	NC	AD In	AD In	AD In
21	GND	21	GND		NC	NC	NC	NC	NC
22	I	22	DCD_In		NC	NC	NC	NC	NC
23	O	23	CTS	7	CTS	CTS	CTS	CTS	CTS
24	NC	24	NC		NC	NC	NC	NC	NC
25	NC	25	NC		NC	NC	NC	NC	NC
26	I	26	BDSEL	12	Test Mode/ Packet Frame	9600 Baud/ Packet Frame	9600 Baud	9600 Baud	9600 Baud
27	I	27	RTS	8	NC	RTS	RTS	RTS	RTS
28	NC	28	NC		NC	NC	NC	NC	NC
29	NC	29	NC		NC	NC	NC	NC	NC
30	NC	30	NC		NC	NC	NC	NC	NC
31	NC	31	NC		NC	NC	NC	NC	NC
32	O	32	DSR	6	Hop Frame	Hop Frame	Hop Frame	NC	Hop Frame
33	NC	33	NC		NC	NC	NC	NC	NC
34	I	34	DTR	4	NC	NC	GI0	GI0	GI0
35	NC	35	NC		NC	NC	NC	NC	NC
36	O	36	DCD_Out	1	NC	NC	GO0	GO0	GO0
37	I	37	Write Enable	14	Write Enable	Write Enable	GI1	GI1	GI1
38	I	38	µP _Reset	15	µP Reset	µP Reset	µP Reset	µP Reset	µP Reset
39	VCC	39	VCC	11	VCC	VCC	VCC	VCC	VCC

J1 Pin #	Type	AC5124 Pin #	AC5124 Signal Name	AC1524 AC3124 AC4424 AC4490 AC4486 AC4868 Pin #	AC1524 AC3124 Signal Name	AC4424 Signal Name	AC4490 AC4486 Signal Name	AC4790 Signal Name	AC4868 Signal Name
40	GND	40	GND	16	GND	GND	GND	GND	GND

I – Input to the transceiver
O – Output from the transceiver
NC – No Connection (though there is an internal connection in some instances, therefore, this pin should be left disconnected)

Note: The 40 pin header (J1) on the SDK board maps directly (pin-for-pin) to the 40 pin connector (J3).

Interfacing the AC DVK to RS232 Hardware

The DVK serial board is defined as a DCE (Data Communications Equipment). DCE is wired to interface directly with DTE (Data Terminal Equipment). Typically, DTE is defined as a PC and DCE is defined as a peripheral. To interface DCE to other DCE or DTE to other DTE, a null modem is required. The null modem swaps pins to convert a DCE to a DTE and vice-versa. Normally, a null modem consists of a female and a male DB9 connector. A typical null modem configuration is shown below.

Table 6: DTE, DCE and Null Modem Signal Definitions

DCE Pin #	DCE Signal Name	DCE Direction	DTE Pin #	DTE Signal Name	DTE Direction	Null Modem Female DB9	Null Modem Male DB9
1	DCD	O	1	DCD	I	1	4 or NC
2	TXD	O	2	RXD	I	2	3
3	RXD	I	3	TXD	O	3	2
4	DTR	I	4	DTR	O	4	6 and 1 or NC
5	GND		5	GND		5	5
6	DSR	O	6	DSR	I	6	4 or NC
7	RTS	I	7	RTS	O	7	8
8	CTS	O	8	CTS	I	8	7
9	RI	O	9	RI	I	9	NC

Interfacing the AC DVK to RS485 Hardware

The SDK serial board has been designed to interface to RS-485 equipment. If such operation is desired, the COMM Select jumper should be set to RS485 Enable. The RS-485 circuitry used by the SDK board has been specially designed to negate the requirement for a DE/RE signal. Thus, the receiver is always enabled unless the transceiver has something to send to the OEM host. The OEM must ensure that the OEM host does not send data at the same time as the transceiver; otherwise a RS-485 contention occurs because the RS-485 hardware is half duplex.

Table 7: RS-485 Header Pins

RS-485 Pin Name	Description
A TRUE	The non-inverted form of the serial data. This pin is at rest high.
B INVERT	The inverted form of the serial data (exact inversion of A TRUE). This pin is at rest low.
GND	GND

RS-485 Pin Name	Description
+5V	This is regulated 5V output from the serial board for general purpose use. A maximum of 100 mA should be drawn through this node.

Power Requirements

The serial board employs a National LM2940 linear regulator to regulate the incoming voltage to 5VDC. Due to heat dissipation limitations and current requirements, a maximum of 10VDC should be present at connector J4. A minimum of 5.5V should also be present at the connector.