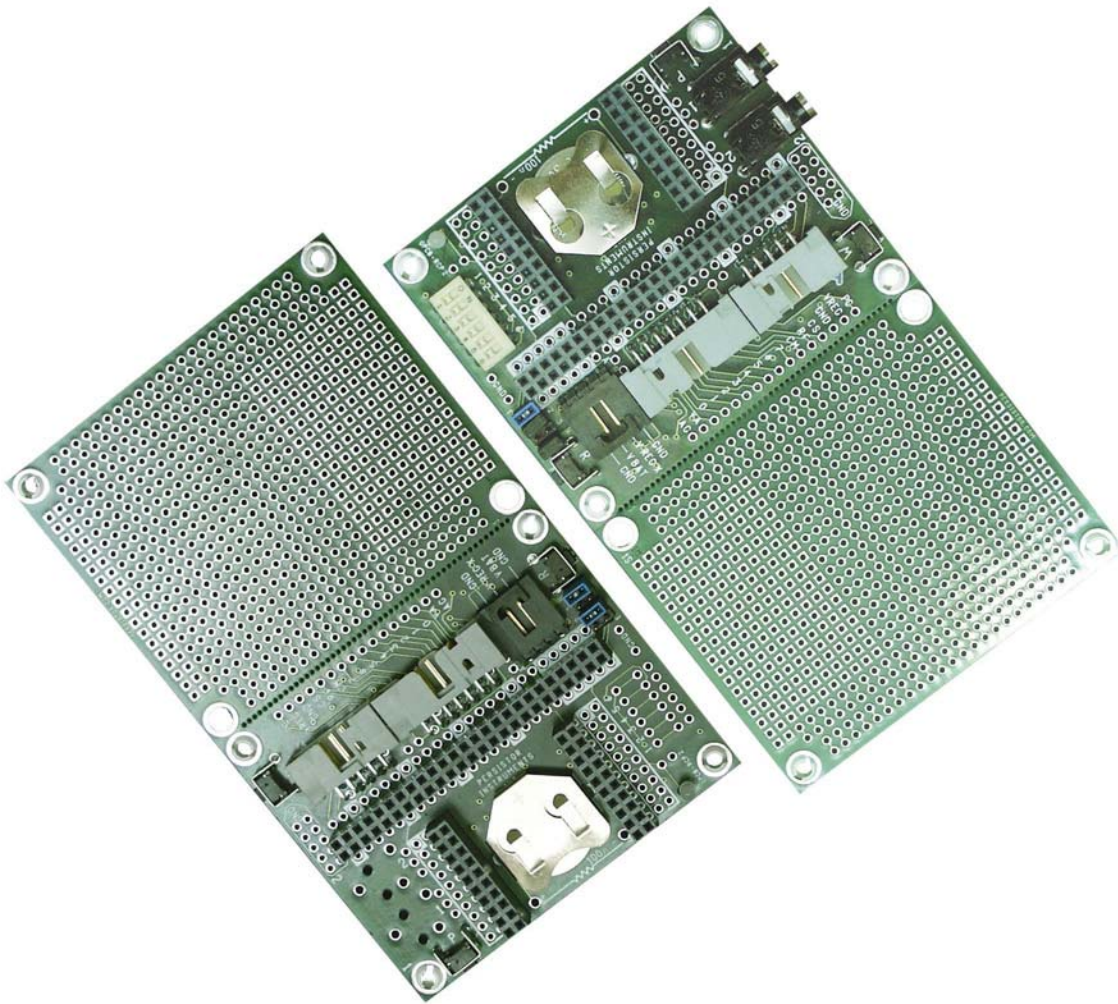


# PERSISTOR<sup>®</sup>

## R2 RecipeCards DataSheet



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# Introduction and Feature List

This document describes the R2 family of Persistor Instruments RecipeCards based on the 3" X 5" printed circuit board labeled RCP2. A RecipeCard is a base board in which to mount a Persistor Instruments CF1 or CF2 single board computer.

As of this writing, the Persistor part number possibilities for this products are:

<b>Part Number</b>	<b>A/D converter</b>	<b>Auxiliary UARTs</b>
R2	none	
R2AU	none	yes
R212	MAX146 12 bit A/D	
R212AU	MAX146 12 bit A/D	yes
R216	ADS8344 16 bit A/D	
R216AU	ADS8344 16 bit A/D	yes

## Features available on the R2 family of RecipeCards are:

- Sockets for mating Persistor CF2
- Right angled connector for applying power
- Right angled onnector for communications cable
- Backup Battery
- Buttons for Reset, Wake, and PBM
- 3 color LED

While it is possible to manufacture all these variations, at the time of this writing Persistor Instruments plans only to stock the R212 and the R216AU. The other models are available on a special order basis.

*NOTE: The original Persistor RecipeCard for Data Acquisition (PRCPDAQ) printed circuit board was slightly different than this product. The schematic for that product has been included on Persistor MotoCross or PicoDEV CDs through early 2002, entitled; "Persistor Recipe Card PRC-PLG". This schematic should not be used with this family of products due to various detail differences. Please refer to the schematics at the back of this document.*

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# CF2 Pin Names and Identification

For prototyping, or probing, the RecipeCard presents connection points for every CF2 connection. The RecipeCard uses silkscreen to help identify the CF2 pins for you.

## Address Connector (A)

With the CF2 seated in the RecipeCard, and the RecipeCard sitting on its 'feet', the 2 X 10 position Address Connector is on the right. The CF2 documentation refers to this as connector 'A'. For connections to the Address connector, a set of pads is presented immediately adjacent to the connector and outlined with a white rectangle. Pin one of this pad set is indicated by a white square. The connections on the Address connector are:

<i>Signal</i>	<i>Pin</i>	<i>Pin</i>	<i>Signal</i>
Addr1	1	2	Addr19
Addr3	3	4	Addr2
Addr5	5	6	Addr4
Addr7	7	8	Addr6
Addr9	9	10	Addr8
Addr11	11	12	Addr10
Addr13	13	14	Addr12
Addr15	15	16	Addr14
Addr17	17	18	Addr16
CLKOUT	19	20	Addr18

For more detail on the CF2 pin functions, you should see the CF2 documentation.

## Data Connector (B)

With the CF2 seated in the RecipeCard, and the RecipeCard sitting on its 'feet', the 2 X 10 position Data Connector is on the left. The CF2 documentation refers to this as connector 'B'. For connections to the data connector, a set of pads is presented immediately adjacent to the connector and outlined with a white rectangle. Pin one of this pad set is indicated by a white square. The connections on the data connector are:

<i>Signal</i>	<i>Pin</i>	<i>Pin</i>	<i>Signal</i>
Data1	1	2	Data0
Data3	3	4	Data2
Data5	5	6	Data4
Data7	7	8	Data6
Data9	9	10	Data8
Data11	11	12	Data10
Data13	13	14	Data12
Data15	15	16	Data14
/CS8	17	18	/CS10
R/W	19	20	CLKIN

For more detail on the CF2 pin functions, you should see the CF2 documentation.

## ***I/O & Other Connector (C)***

The RecipeCard also presents a 2 X 25 position socket for the remaining CF2 connections. The CF2 documentation refers to this as connector 'C'. For connections to this connector, a set of pads is presented on either side of it. The first 10 pins of the connector are positioned in the standard BDM format and heavily outlined with white silk screen to remind you which end is pin 1. Continuing down the connector, the RecipeCard has a white square around every 5th pin to help you find any pin of interest. The connections on the data connector are (and white squared pins indicated in BOLD):

<b><i>Signal</i></b>	<b><i>Pin</i></b>	<b><i>Pin</i></b>	<b><i>Signal</i></b>
/DS	1	2	/BERR
GND	3	4	/BKPT
VBAK*	5	6	FREEZE
/RESET	7	8	DSI
VREG	9	10	DSO
VLIN	11	12	/SHDN
VBAT	13	14	VBBK
/PCS2	15	16	/SCK
/PCS3	17	18	MOSI
/PCS1	19	20	MISO
/PCS0	21	22	TPU1
TPU2	23	24	TPU3
TPU4	25	26	TPU5
TPU6	27	28	TPU7
TPU8	29	30	TPU9
TPU10	31	32	TPU11
TPU12	33	34	TPU13
TPU14	35	36	XCLK* (don't connect)
TPU15	37	38	/WAKE
/IRQ5	39	40	/IRQ7
/IRQ2	41	42	MODCLK
RSRXD	43	44	RSTXD
/RXD	45	46	/TXD
RSRTS	47	48	/RTS
RSCTS	49	50	/CTS

\* Pin (C) 5 is a pass through connection for the original CF1

\* Pin (C) 36 is CTM31L for the original CF1

For more detail on the CF2 pin functions, you should see the CF2 documentation.



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# Power Connector and Cable

The RecipeCard presents a 4 pin shrouded, polarized Molex connector for applying power to the CF2. Persistor part number CAB-POW-RCPDAQ is a two wire cable which mates to this connector to provide GND and VBAT connections. The other two connections which are not made are a 2nd ground, and VREGX.

VREGX is either a 'no connect' or can be connected to VREG by installing a shunt on jumper position 3. Jumper position 3 is adjacent to the power connector in a 2X4 block of pins, and is indicated on both sides of the RecipeCard with silkscreen.

The CF2 has an on board regulator to provide 3.3 volts. This output is called VLIN. Normally, VLIN is brought off the CF2 and then fed back in to VREG; the positive input to the CF2 components. The RecipeCard makes this connection with a shunt installed on jumper position 4, which is adjacent to the power connector in a 2X4 block of pins, and is indicated on both sides of the RecipeCard with silkscreen.

The RecipeCard places a 1uF capacitor between VBAT and GND, as well as a 10uF capacitor between VREG and GND.

You should have received some spare crimp pins with your RecipeCard. These were included in case you desire to add VREG and a 2nd GND wire to your power cable. You should also have received some spare shunts in case you desire to make the VREGX connection at jumper position 3.

*NOTE: The RecipeCard does not protect against over voltage or reverse voltage. Please review the warnings and precautions in the CF2 Getting Started Guide.*

# Communication Connector and Cable

The RecipeCard presents a connector for a communication cable. A cable is normally included with the RecipeCard and is terminated with a standard PC com port connector. The Persistor part number for this cable is CAB-COM-RCPDAQ. If you desire to make your own cable, the mating connector is listed at the end of this document. The RecipeCard has pads for direct solder connections if desired, outlined by a white rectangle, and pin one of the 10 pin connector is highlighted with a silk screened white square. The connections from the CF2 through CAB-COM-RCPDAQ are as follows:

<b>CF2 Function</b>	<b>10 pin Connector</b>		<b>female DB9 Connector</b>	<b>PC Host Function</b>
NC	Pin 1	to	Pin 1	DCD
NC*	Pin 2*	to	Pin 6	DSR
RSTXD	Pin 3	to	Pin 2	RXD
RSCTS	Pin 4	to	Pin 7	RTS
RSRXD	Pin 5	to	Pin 3	TXD
RSRTS	Pin 6	to	Pin 8	CTS
NC*	Pin 7*	to	Pin 4	DTR
NC	Pin 8	to	Pin 9	RI
GND	Pin 9	to	Pin 5	GND
NC	Pin 10			

\*Pin 2 and 7 are connected together on the RecipeCard, which is necessary for some types of terminals to recognize a connection.

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# Backup Battery

A CR2032 lithium backup battery is installed on this RecipeCard. It is readily available in retail stores. When replacing the battery, be sure to install it with the + sign NOT facing the board.

The CF2 does NOT require a backup battery to operate. However, if you intend to use the low power suspend modes of the CF2 or if you will use dynamic CompactFlash card changes (CCC from PicoDOS) then you WILL need a backup battery.

The original CF1 DOES require the backup battery for proper start up.

A 100  $\Omega$  resistor is installed in series with the positive side of the battery and the CF2 VBBK input. There are clip lead pads on the edge of the board next to the lithium battery. These pads are connected to either side of the resistor to assist in measuring current drain from the backup battery. With a multimeter set to millivolts clipped to these pads, the user might see 0.5mV voltage drop across the resistor. Because of the 100  $\Omega$  resistor, this can be translated to 5 uA of current drain consumed by the CF2

## RESET, PBM and WAKE Buttons

Three right angled buttons are presented at various edges of the RecipeCard.

**RESET** is located near the power connector. The silkscreen near the button says; "R" and "RES". This button, when momentarily depressed, will cause a full hardware reset.

**PBM** is located at the "front" of the RecipeCard. Note that we call this edge the front because the RecipeCard may be mounted inside an enclosure in such a way as to present the CompactFlash card ejector, the PBM button, and the LED at the face of the enclosure. The silkscreen near the button says; "P" and "PBM". The PBM button is used to pull a CF2 back to the PicoDOS monitor, instead of running an installed program, when power is applied. See your CF2 documentation for more information about using the PBM function.

**WAKE** is located near the communication connector. Once again the silkscreen helps identify this switch. This button can be used programmatically to wake the CF2 from certain low power modes. See your CF2 documentation for more information about using the /WAKE capability.

## LED

The LED is located at the "front" of the RecipeCard to be visible from the face plate of an enclosure. Setting pin 35 low, and pin 37 high will turn the LED on red. The opposite state will turn the LED on green. Alternating the state of the pins at about 100KHz will cause the LED to appear to be on orange.

If you have just received your CF2 and are anxious to do something, you can turn the LED on from the PicoDOS prompt with the PC (pin clear), PS (pin set) and PT (pin toggle) commands.

NOTE pin 35 and pin 37 are understood by PicoDOS to be TPU14 and TPU15.

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## **12 bit A/D (R212 models only)**

The R212 versions of this RecipeCard are built with a Maxim MAX146 12 bit, 8 channel A/D converter. The datasheet for the A/D converter is available on your PicoDEV CD as well as various programming examples from Persistor, including a full blown ready to run, settable data logging application entitled PicoDAQ.

## **16 bit A/D (R216 models only)**

The R216 versions of this RecipeCard are built with a Burr Brown ADS8344 16 bit, 8 channel A/D converter with a 2.5 volt Linear Technology LT1461 voltage reference. The datasheet for the A/D converter is available on your PicoDEV CD as well as various programming examples from Persistor.

## **A/D connections**

The analog connections are available at a 14 pin shrouded header as well as brought to a single row of 16 solder pads. The two additional connections of the solder pad strip are VREG and GND

Pin one of the header is the pin nearest the arrow molded into the header. The part list at the end of this document tells what connector can be used to connect to this header, should you choose to use a cable.

<b>Signal</b>	<b>Pin</b>	<b>Pin</b>	<b>Signal</b>
PC	1	2	/PCS3
COM	3	4	VREF
AD6	5	6	AD7
AD4	7	8	AD5
AD2	9	10	AD3
AD0	11	12	AD1
VANA	13	14	AGND

The back of the RecipeCard has a wide trace with the silkscreen label; "LINK". This is the connection between AGND and GND. You may also note 4 solder pads labeled A, B, C, and D. These are referenced on the schematic as PA, PB, PC, and PD.

- PA is connected to pin 3 (SHDN) of the voltage reference (R216 models)
- PB is connected to pin 10 (SHDN) of the A/D converter (R212 & R216 models)
- PA and PB are connected to each other
- PC is just a spare pad which is brought out on the pin header.
- PD is connected to pin 16 (STRB of MAX146) (BUSY of ADS8344).

SHDN of the voltage reference and A/D converter can be connected to pin 28 (TPU 7) by installing a shunt on jumper position 1.



# Auxiliary UARTs (R2AU and R2xxAU)

R2AU, R212AU, and R216AU are manufactured with a circuit which drives two TPU software UARTS with RS232 levels. The data sheet for the Maxim MAX3222 RS232 driver should be included on the PicoDEV CD, as well as sample code to drive these software UARTS. When the circuit is installed, and when all the six dip switch positions are ON, the following connections will be made:

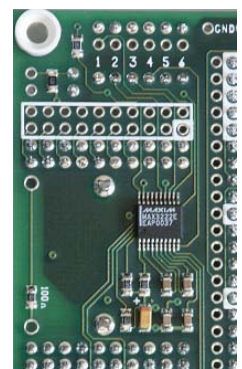
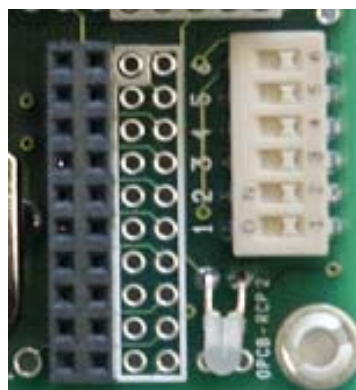
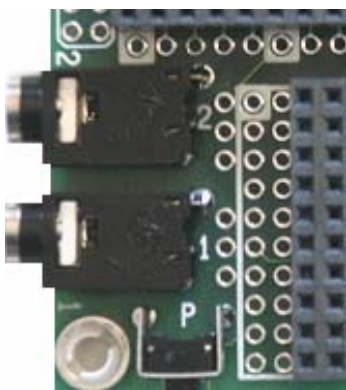
Pin 34 (TPU13)	connects to T1 IN	becoming AUX1 out
Pin 33 (TPU12)	connects to R1 OUT	becoming AUX1 in
Pin 32 (TPU11)	connects to T2 IN	becoming AUX2 out
Pin 31 (TPU10)	connects to R2 OUT	becoming AUX2 in
Pin 30 (TPU9)	connects to /EN	
Pin 29 (TPU8)	connects to /OFF	

The dip switch is provided so that the TPU lines can be separated from the RS232 driver in order to use them for other purposes. The user can disconnect either auxiliary UART without affecting the operation of the driver. /EN is pulled up and /OFF is pulled down leaving both transmit and receive drivers off by default. If the dip switch for these two signals (5 and 6) is left open then the driver is disabled. In order to use the auxiliary UARTs you must close the dip switches for these signals and actively drive them in software. Drive pin 29 high to enable the transmitter driver and drive pin 30 low to enable the receiver driver. The RecipeCard is normally shipped with the RS232 driver enabled. Users who do not wish to use this feature should open all of the dip switches to save current and disconnect the TPU lines from the driver. The silk screen indicates auxiliary channels 1 and 2.

## Adding Auxiliary UARTs

If you do not have a model with the auxiliary UARTs, you can install this circuit if you have the ability to solder surface mount parts. The part list at the end of this document lists the parts necessary and the following diagrams will help illustrate the positions where they must be installed.

The IC is installed with pin one closest to the bank of 8 components. In the photo, the bank of 8 components contains (4) 0.1uF caps (brown), (3) 1M resistors (black), and (1) polarized 1uF cap. A fourth 1M resistor is installed in the visible corner, near the 1 of the 1 2 3 4 5 6.



On the opposite side of the board, the DIP switch must be installed if you wish to be able to connect and disconnect the TPU lines from the RS232 driver. If you wish to hard wire the TPU lines, just solder jumper wire in the row of holes provided.

The two jacks, off course need to be installed as well. A set of three holes is provided behind the jacks locations in case you choose to use a simple row of 0.1" centered pin strips or headers.

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# Four Jumpers

There is one block of 4 jumper positions by the power connector. The positions are labeled in silkscreen from 1 to 4, and noted on the schematic as JP1 to JP4.

JP1 connects SHDN of the A/D chip to pin 28 (TPU7), shipped uninstalled.

JP2 connects pin 35 (TPU14) to one side of the LED, shipped installed.

JP3 connects VREGX on the power connector to VREG of the CF2, shipped uninstalled.

JP4 connects VLIN (CF2 regulator out) to VREG (CF2 components), shipped installed.

## Breakaway Prototyping Area

You may have noticed the prototyping area is separated from Persistor circuitry by a line of small holes. If desired, the prototyping area may be snapped away.

*NOTE: Flexing the printed circuit board to break the prototyping area away may damage or disconnect surface mount components.*

If you choose to separate the prototyping area, we recommend you do so before installing components. First remove the feet from the prototyping area corner holes. Next hold the prototyping area firmly down against a table surface, with the connectors on the 'bottom', and with the serration lined up with the edge of the table. Push down on the Persistor circuitry with a steady slow pressure, being sure to continue to firmly hold the prototyping area against the flat table surface. A hack saw could be used too!

## Part List

Customers who use Persistor Instruments PERCF2 products are welcome to use any part of the RecipeCard circuit in their own add on boards. Following is a list of components that are used, or can be used, by the R2 family. Small quantities of these can be purchased from Persistor Instruments. Many of these items are also readily available at [www.DigiKey.com](http://www.DigiKey.com).

### Sockets for the CF2's three pin strips:

Socket, 2 pins by 10 pins	Samtec	SSW11021FD
Socket, 2 pins by 25 pins	Samtec	SSW12521FD

### Sockets for cables

Socket for power cable	Molex	705-53-0003
Socket for communication cable	3M	2510-5002UB
Socket for A/D cable	3M	2514-5002UB

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## **Mating cables**

Power Cable	Persistor	CAB-POW-RCPDAQ
Communication cable A/D cable	Persistor	CAB-COM-RCPDAQ

## **Mating connectors**

To power cable socket	Molex	50-57-9404
To communication cable socket	3M	3473-6610
To A/D cable socket	3M	3385-6614

## **Other standard items on RCP2**

Backup battery holder	DigiKey	3003K-ND
Backup battery	Sanyo	CR2032
Jumper shunts (0.1" spacing)	Sullins	SSC02SYAN
2 color bidirectional LED	Lite On	LTL-14CHJ
220Ω resistor in series with LED	Panasonic	ERJ6GEYJ221V
RES, WAKE, PBM Switches	C&K	PTS635VL39

## **12 bit, 8 channel A/D circuit**

A/D converter	Maxim	MAX146BEAP
(2) 0.1uF caps	Panasonic	ECJ2VB1E104K
(2) 10uF caps	Panasonic	ECST1AY106R

## **16 bit, 8 channel A/D circuit**

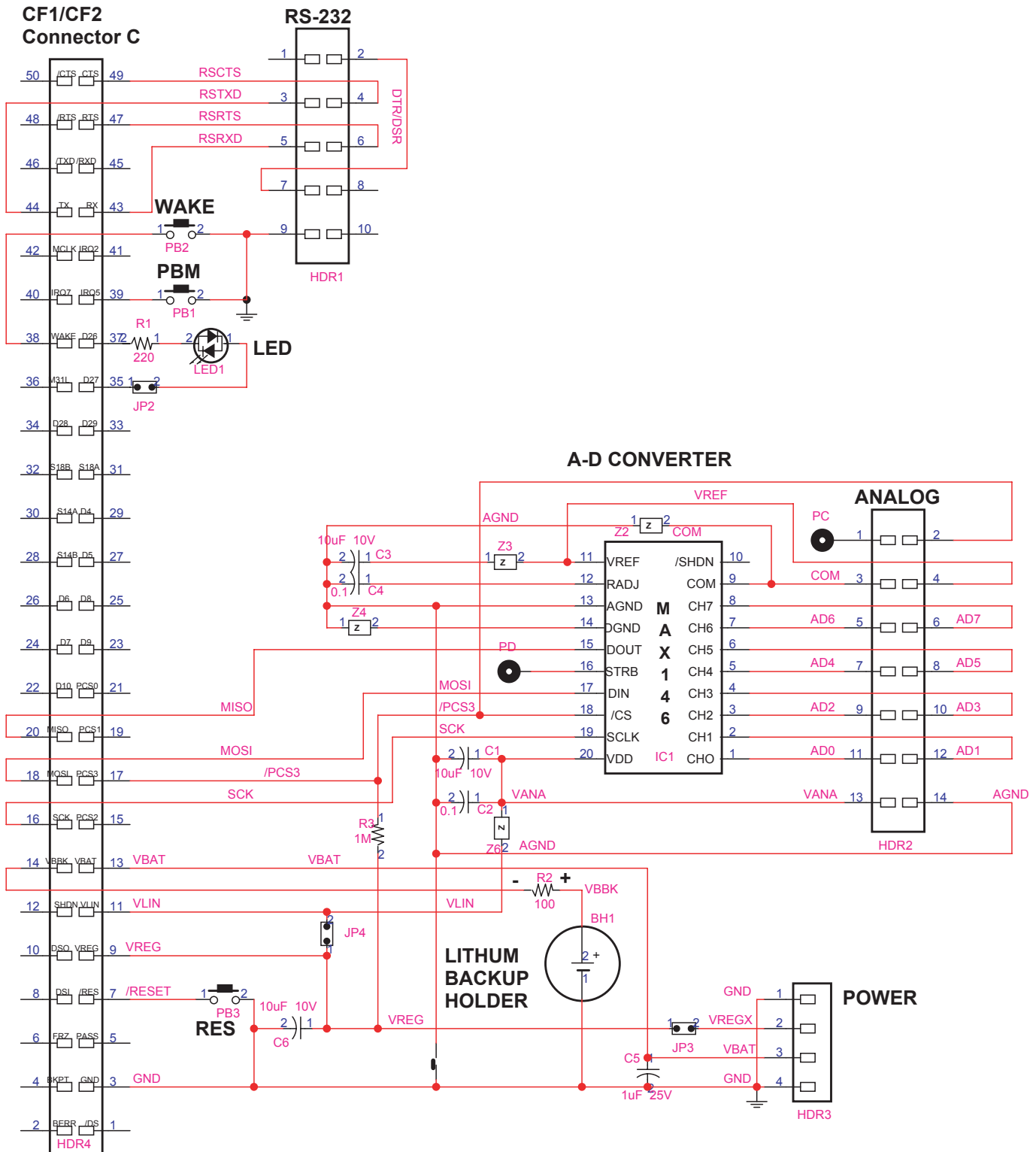
A/D converter	Texas Inst	ADS8344NB
Voltage Reference	Linear Tech	LT1461AIS8-2.5
(2) 0.1uF caps	Panasonic	ECJ2VB1E104K
(2) 10uF caps	Panasonic	ECST1AY106R

## **Auxiliary UART circuit**

RS232 level driver	Maxim	MAX3222EEAP
(4) 0.1uF caps	Panasonic	ECJ2VB1E104K
(1) 1.0uF cap	Panasonic	ECJ3YB1E105K
(4) 1M pull ups / downs	Panasonic	ERJ6GEYJ105V
Dip switch	Grayhill	90B06S
(2) 3.5mm stereo jacks	Shogyo	SJ-0537-3RT JACK
Mating cables	Persistor	CAB-COM2-RCPDAQ



# R212 Schematic



# R216AU Schematic

